ESCORT-LINK Service Manual
Model E3200A

ESCORT-LINK

CENTRAL STATION

SERVICE MANUAL

SEPTEMBER 1992

REVISION C

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WARRANTY

ESCORT is warranted against defects in materials and workmanship for the period of 12 months from the date of shipment to original purchaser. Batteries, cables, cuffs and sensors are warranted three months from date of shipment. Warranty is valid only to the original buyer. Defective equipment should be returned freight prepaid. Equipment returned with defective parts and assemblies will be either replaced or repaired. This warranty is not applicable if repair has been attempted or if the instrument has been damaged due to operation outside the environmental and power specifications for the product, or due to improper handling or use.

If any default develops, notify Medical Data Electronics, giving full details of the difficulty, including the model and serial number of the device. On receipt of the shipping instructions, forward the device prepaid, and repairs will be made at the factory. If requested, an estimate will be made before work begins, provided the device is not covered by warranty.

The foregoing warranty is in lieu of all other warranties expressed or implied, including but not limited to any implied warranty or merchantability, fitness or adequacy for any particular purpose or use. Medical Data Electronics shall not be liable for any special, incidental or consequential damages.

Factory Service is available by obtaining an RMA number from the MDE Technical Support Department. Please have model number and serial number ready when calling.

WARNING!

To avoid personal injury, the user should not perform any servicing unless qualified to do so.

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SPECIFICATIONS

CHAPTER 1

LINK CENTRAL STATION SPECIFICATIONS

Display Type: 14" color, computer video display

Display Resolution: VGA 640 x 480 pixels

Central Processor: Standard PC 386DX 33MHz

Central Memory: 8M byte RAM

User Interface: Touchscreen

Number of Patients Monitored: 1 to 32

Waveforms Displayed: Up to 8 waveforms, selectable

Parameters Monitored: HR, RR, IBP (SYS, DIAS, MEAN), NIBP (SYS, DIAS, MEAN), SaO2, T

Number of Parameters Monitored Per Patient: Up to 6

Patient Data Display:
3 formats selectable depending on number of patients monitored:
1) Parameters, waveform, and alarm status
2) Parameters, and alarm status
3) Alarm status only

Alarm Response Time From Bedside: 4.5 seconds

Alarm Handling: Central Station ALARM SUSPEND key temporarily suspends audible alarms for 3 minutes. Alarm limits are adjusted, enabled, and disabled via the bedside monitor.

Telemetry Transceiver Frequency: UHF 450-470 MHz; several network frequencies available, factory selected; one frequency per ESCORT-LINK network.

Transmission Power: 50m watt

Modulation: FSK 18,500 Hz/10,900 Hz

Range: 450 ft. outdoor line of sight
200 ft. indoor line of sight
150 ft. through wood/concrete walls
75 ft. through metal walls

Transmission Protocol: Proprietary MDE digital LAN

LINK CENTRAL STATION SPECIFICATIONS - cont'd

Trending: 32 patients, 6 parameters per patient; 1 and 24 hour plots; 10 second sampling intervals; 1 hour windows selectable within last 24 hours

Weight: Video display - 32 lbs.
PC base - 31 lbs.

Size: 14" (H) x 13 3/4" (W) x 16 1/8" (D) - video display
6" (H) x 14" (W) x 16" (D) - PC base

Environment: 5 to 40 degrees C
0 to 90% humidity

AC Main: 115/230 VAC ±10% ; 50/60 Hz

Power: 300 watts

Certification: FCC 90.217
UL 1950 & CSA

INSTALLATION

CHAPTER 2

WARNINGS!

WARNING

The MDE LINK Central Station should be installed and serviced by Qualified Service Technicians only. There is a potential for electric shock if any covers are removed for either the LINK Central Station or ESCORT bedside monitors.

WARNING

The ESCORT-LINK radio interface emits radio frequency energy every 2.25 seconds. When patient monitoring cables from this or other instruments are placed in close proximity to the transmitting antenna, enough energy may be received to produce an artifact on the monitors during use. Do not route patient cables over the top of the monitor or near the antenna. If any periodic artifact is observed, reposition patient cables and contact the MDE Technical Support Department.

WARNING

The ESCORT-LINK must never be connected to an existing antenna system because damage to the antenna system is likely and existing antenna systems will not allow signals to pass in both directions.

2.0.0 INSTALLATION

2.1.0 UNPACKING, INSPECTION

When the shipping boxes for the ESCORT-LINK Central Station Network are received, they should be inspected for any external damage or stress. If damage to any of the boxes is noticed, the carrier should be notified immediately. All shipping boxes should be retained in the event units need to be returned to the factory.

The LINK Central Station base and LINK display screen should be removed from their shipping boxes and inspected for any physical damage. Bedside monitors, as well as any accessories should also be carefully inspected.

If any damage is found, contact the carrier directly. If for any reason any part of the ESCORT-LINK Central Station needs to be returned to the factory, a Return Material Authorization number (RMA #) should be obtained. To do so, simply call the MDE Technical Support Department with the serial number of the unit and a description of why the unit is being returned.

IMPORTANT!: All returned units should be reshipped in their original shipping boxes and packing material.

2.2.0 INVENTORYING CONTENTS

Upon receipt, all box contents should be inventoried to assure necessary parts have been received.

Each LINK Central Station should have:

* A LINK display screen.
* A LINK PC base.
* An Antenna (or remote antenna system).
* Two power cords (for display and base).
* 3 1/2" floppy disk(s) containing current software versions.

NOTE: If your system is configured with full disclosure, no floppy disks will be provided. Main software is contained on the hard disk.

Each ESCORT-LINK bedside should have:

* An antenna.
* A power cord.
* And if configured with a battery option, a battery.

2.3.0 HARDWARE SERIAL NUMBERS

Identification of the individual units by serial number should be documented at this time. The bedside serial number is

located at the back of the monitor, usually in the upper left corner. The serial number for the LINK display is located on an MDE label at the back of the unit. The serial number for the LINK PC base is directly under the fan exhaust.

In addition to documenting the serial numbers, note should be taken of the LINK network frequency, and bedside monitor addresses. Frequencies are color coded, according to the chart below. Bedside and central station should be the same color code. The central station is always address 00. The bedside address can be found on a label at the front of the unit. This label also contains frequency color code and ID#. Some of the colors and their associated frequencies are shown below.

Color	Frequency
Red/Green	457.6000mHz
Org/Org	467.7500mHz
Blue/Wht	464.8875mHz
Green/Wht	464.9875mHz
Yellow/Wht	464.6875mHz
Red/Wht	462.7625mHz

2.4.0 SITE PREPARATION

Placement of the LINK Central Station should involve the following considerations:

PHYSICAL SPACE

16" (W) X 18" (D) X 24" (H)

WEIGHT SUPPORT

65 Pounds

POWER

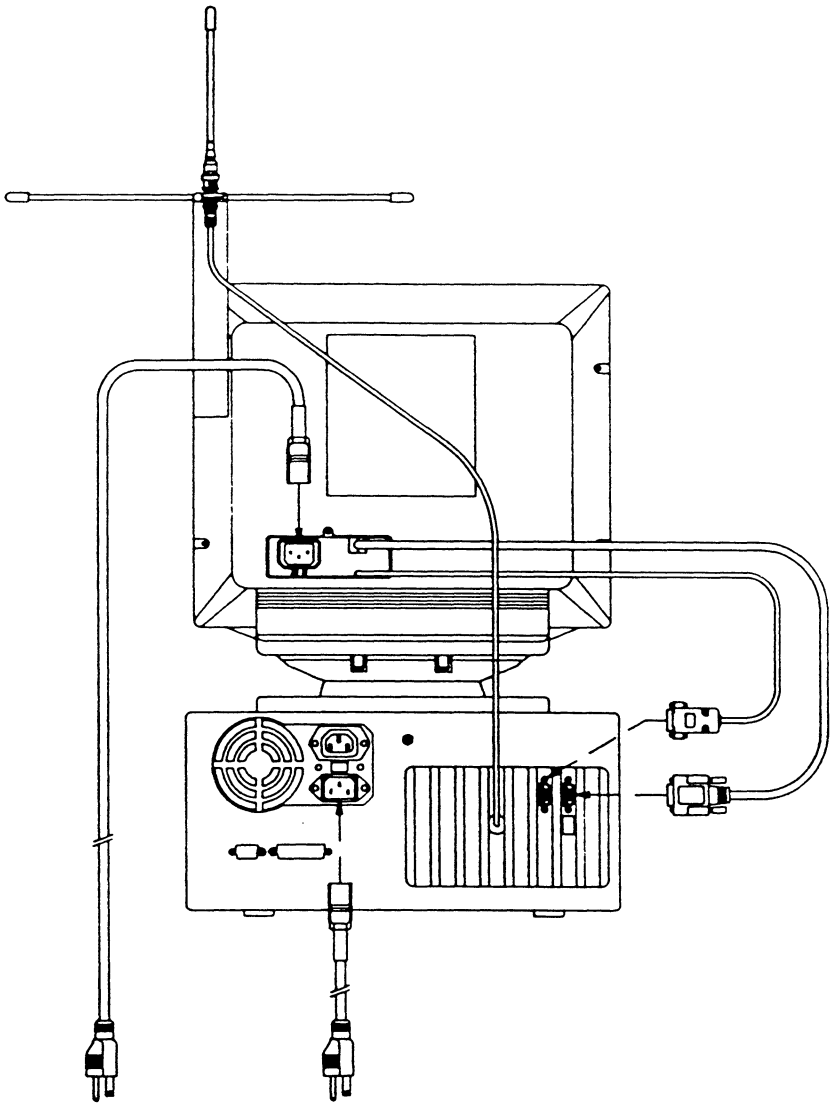
(2) 110AC 60Hz OUTLETS PROVIDING 3 AMPS OF CURRENT

2.5.0 SETTING UP THE SYSTEM

After the site has been properly prepared and boxes have been unpacked and inventoried, the system can be set up.

Place the LINK base at the central station site. Place LINK display on top of the base.

There are two cables coming out of the LINK display. These are connected to the LINK base. The 15 pin connector goes to the VGA card. The 9 pin connector goes to the touchscreen interface card. See drawing below. The power cords should be run from the display and the PC base, and trimmed properly.



To install the antenna, simply connect supplied antenna to BNC connector at the antenna holder and attach to mating velcro on side of the display.

Bedside monitors need to have the antenna installed before being placed at the bedside. Care should be taken to trim the patient cables away for the antenna to avoid trace artifact, see Warnings section of this manual.

2.6.0 POWERING UP SYSTEM

The LINK Central Station is now ready to power up. Install 3 1/2" floppy disk with latest software version to the disk drive. Turn on LINK display with on/off switch located at the front right of the display. Next turn on LINK base at front panel on/off switch. After a few moments, the system is operational. Adjust LINK display brightness and contrast for a comfortable picture.

The 3 1/2 inch system operating disk must remain installed whenever the LINK Central Station is in operation.

NOTE: **If your system has the Full Disclosure option, the system software will be on the hard disk drive. No floppy disk should be installed in the boot drive.**

2.7.0 CONFIGURING SYSTEM

At this point the LINK Central Station needs to be custom configured to hospital requirements. Please refer to the Operator's Manual, section 6, for configuration procedures.

NOTE: Operator's Manual is contained at the back of this manual.

2.8.0 CHECKING RANGE

1. Check each bedside unit for comm ok status, LED ON.

2. Verify adequate fade margin using the Power Level page on the LINK Central Station. Green power bar should be at least to the half way point.

3. Check for off air interference from other sources. Using the Power Level page on the LINK Central Station, turn off all bedside monitors. Green power bar should be no more than 1/4 in amplitude.

ESCORT LINK RANGE AND ANTENNA ISSUES

CHAPTER 3

3.0.0 ESCORT-LINK RANGE AND ANTENNA ISSUES

3.1.0 FREE SPACE RANGE

The ESCORT-LINK has been tested outdoors in a "line of sight" configuration with reliable communications at up to 450 feet (radius). This line of sight specification is given as a reference number only. Almost all applications are indoors with multiple walls between the bedsides and central unit. Therefore, the following indoor range statistics should be used.

3.1.1 INDOOR RANGE

The ESCORT-LINK with one local antenna has been tested indoors through a mixture of concrete and wood frame walls (total of 5), and found to have reliable communications up to a 150 foot radius. However, it was also found that in a hospital with full metal wall stud construction, when going through several walls, radius of coverage was reduced by a factor of approximately 2.

This means that if the central station was put in the center of an area to be monitored, the central should pick up bedsides up to 150 feet in any direction with concrete and wood construction, and approximately 75 feet with metal construction.

This configuration of a single, local antenna at the central station is the standard configuration for ESCORT-LINK. It requires no installation and simply attaches to the rear of the central station. It gives the best overall coverage and is most convenient to use.

PLEASE NOTE: Shielded rooms such as X-ray & CT, will affect range and should be considered when coverage is desired in those areas. Rooms located remotely from the central and its radius of coverage, should also be given special consideration and may warrant the need for an Extended Range Antenna system.

3.1.2. EXTENDED RANGE ANTENNA SYSTEMS

MDE Technical Support will determine, based on construction materials and floorplans depicting areas of coverage, if an Extended Range Antenna System is required. After a determination has been made on coverage, an MDE Technical Representative will install and fine tune the antenna system.

If coverage areas change and require additional antennas, MDE will reassess the original system, and an MDE Technical Representative will again arrive to implement the changes.

PLEASE NOTE: Antenna systems installed or modified without authorization from the MDE Technical Support Department may damage equipment, degrade system performance, and void the warranty.

DESCRIPTION OF SYSTEM

CHAPTER 4

4.0.0 DESCRIPTION OF SYSTEM

4.1.0 OVERVIEW

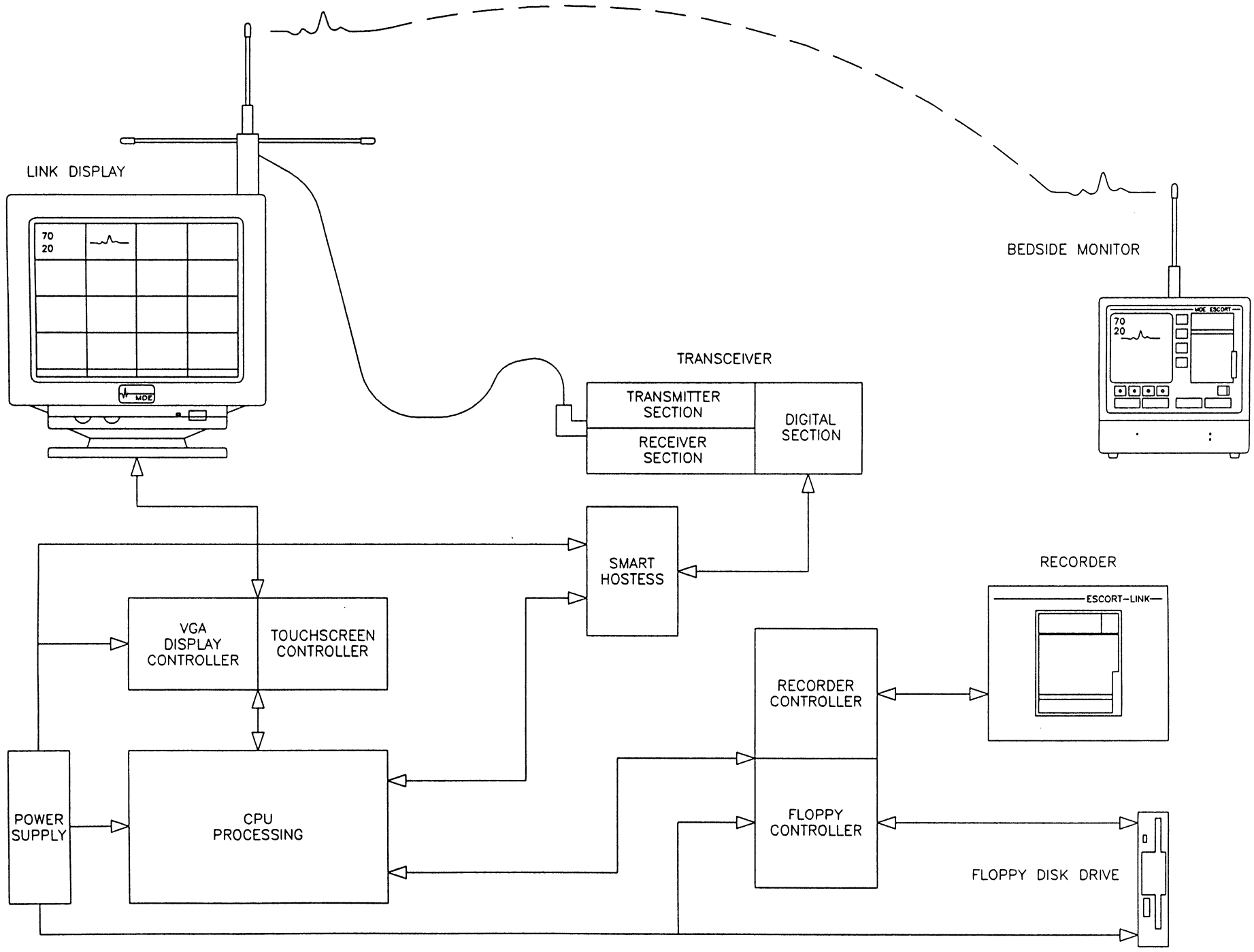
The ESCORT-LINK is a wireless central station system using remote ESCORT series 100's as the bedside monitors. These bedside monitors are equipped with a 50mW transceiver, (TxR) that allow wireless communication with the central station 50mW TxR. Both TxR's operate in the 450MHz range.

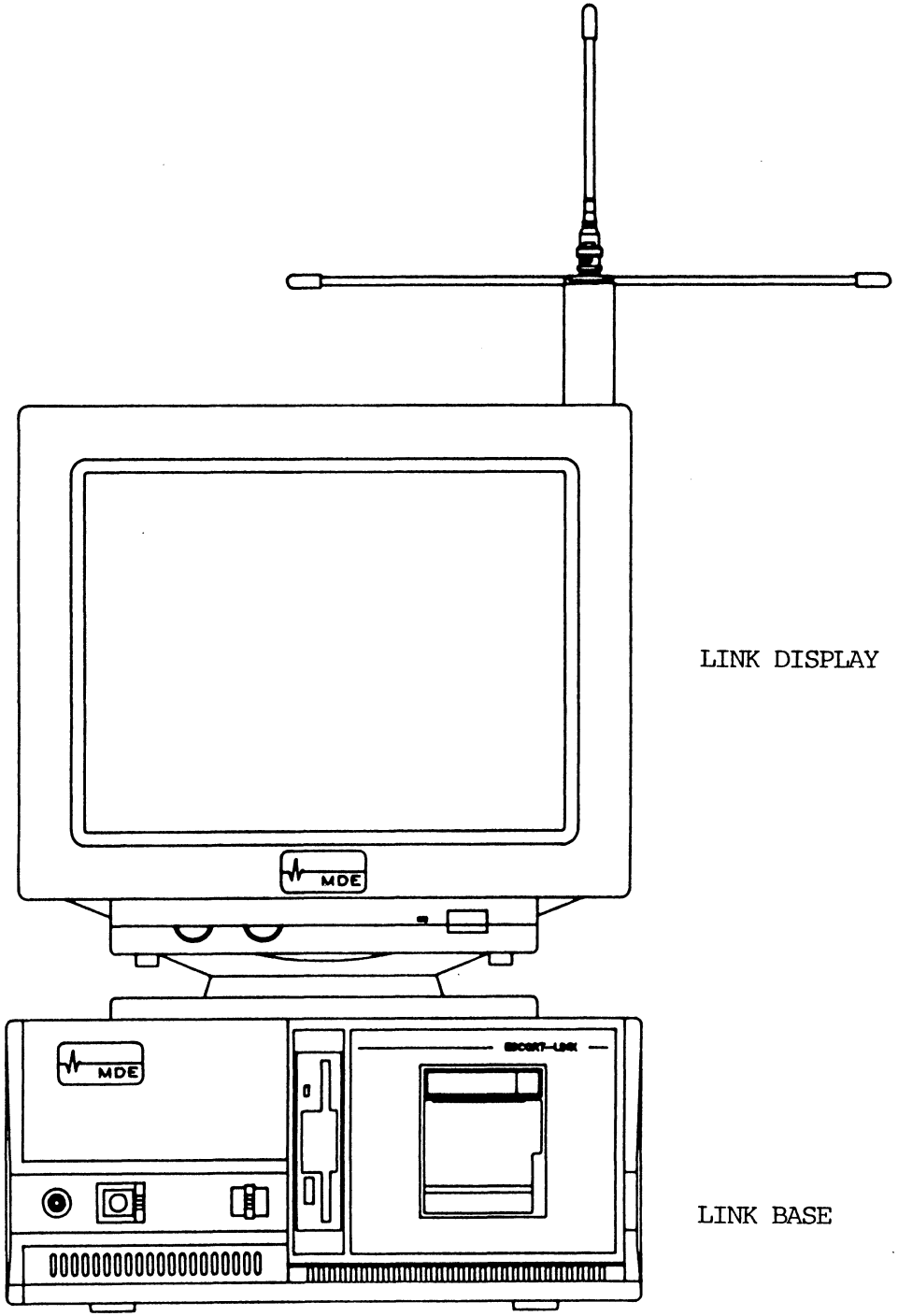
Communication includes physiological waveforms and digital parameters sent from the bedside transceiver at the request of the LINK central transceiver. These "packets" of information (requests for waveforms and parameters, and replies of waveforms and parameters) are sent every 2.25 seconds. Through this communication protocol, waveforms, digital parameters, and alarm conditions from 1 to 32 bedsides can be displayed on the LINK Central Station.

The bedside monitors can be configured with a variety of options including ECG, invasive blood pressure, respiration, NIBP, SaO2, and temperature; all of which can be transmitted to the LINK Central Station for display. The configuration pages in the central station define which of these parameters are displayed on the central station.

Each LINK network is assigned a specific frequency in the 450MHz range. The central station as well as the remote bedsides transmit on that frequency. In addition, the central station and bedsides are assigned specific addresses to allow orderly communication. All central stations are addressed 00 and the bedside's can be addressed 01 through 32.

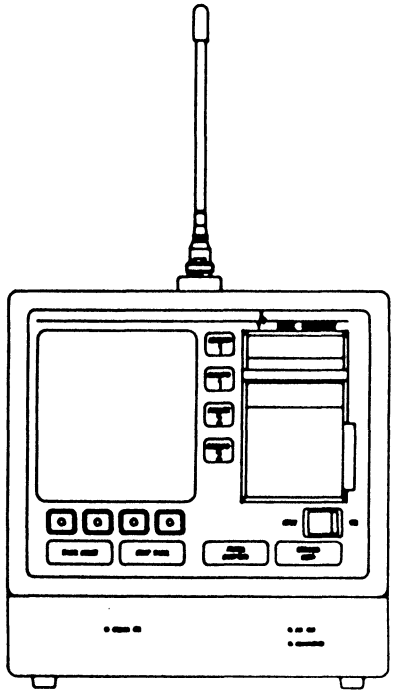
CAUTION: No two bedsides may have the same address within the same LINK network. These identifying parameters make the central station and bedsides incompatible with other networks; doing so could result in improper or no communication.


LINK DISPLAY
70
20
MDE
BEDSIDE MONITOR
MDE ESCORT
70
20
TRANSCEIVER
TRANSMITTER SECTION
RECEIVER SECTION
DIGITAL SECTION
SMART HOSTESS
RECORDER
ESCORT-LINK
VGA DISPLAY CONTROLLER
TOUCHSCREEN CONTROLLER
RECORDER CONTROLLER
POWER SUPPLY
CPU PROCESSING
FLOPPY CONTROLLER
FLOPPY DISK DRIVE



LINK DISPLAY

LINK BASE



ESCORT
BEDSIDE
MONITOR

THEORY OF OPERATION

CHAPTER 5

5.0.0 THEORY OF OPERATION

5.1.0 OVERVIEW

The LINK Central Station Network is comprised of a VGA color display with touchscreen operation, a 386DX PC base, antenna, and from 1-32 bedside monitors. The LINK display is a 14 inch screen that features 640 X 480 pixel resolution and touchscreen input. The PC base is equipped with a 386DX CPU motherboard and a 3 1/2 inch, 1.44M byte disk drive that is used to store LINK software. Additionally, if your system is configured with the Full Disclosure option, a 200MB hard disk drive will be installed which will also contain boot software.

Also, located in the LINK Base are several modular PCBA's; the VGA controller card, touch screen interface card, smart hostess card, disk drive controller card, and recorder data interface card. The LINK Base also contains a switching power supply to provide operating voltages and a RF transceiver, to communicate with the bedside monitors.

5.2.0 VGA INTERFACE CARD

The VGA card is a memory mapped interface between the 386DX CPU motherboard and LINK display screen. The LINK display and VGA card work with a resolution of 640 X 480 pixels. The microprocessor on the VGA card will assume the task of refreshing the screen, freeing the 386DX CPU motherboard for other system tasks.

Data is received from the 386DX CPU bus and is turned into a X, Y, Z format and displayed on the central station screen. The 16 color palette gives a broad range of color selections.

5.2.1 TOUCHSCREEN INTERFACE CARD & CALIBRATION

The touchscreen interface card is interrupt driven to insure all touched data is captured. The X and Y coordinates are scanned for an intersection. When this occurs, the information is sent to the CPU. An untouch data available application program allows the user to select the key desired only upon lifting of the finger. This allows time to select the properly highlighted function.

The touchscreen itself uses Surface Acoustic Wave technology (SAW), with up to 100 touch points per square inch. When a touch occurs, the finger absorbs a portion of the energy flowing in the X and Y directions attenuating the two signals. By comparing the speed of these signals, the touch screen interface card can calculate the touch location.

Calibration for the touchscreen is stored on the software disk. If software is changed, the monitor should be recalibrated and saved during the boot-up sequence. In addition, if the LINK display or the touchscreen is changed, the calibration procedure must be done. Touchscreen calibration should be done when facing the LINK display at the most commonly used viewing angle. This will minimize paralax errors. Touchscreen calibration procedures are software driven and take only a few moments.

5.2.2 HOSTESS INTERFACE BOARD

The Smart Hostess Interface Board communicates between the transceiver and the 386DX CPU motherboard. The 386DX CPU motherboard resets the Smart Hostess then loads the program in to the Hostesses memory. The Smart Hostess Board will then initiate the transceiver to communicate to the 386DX CPU motherboard. Information comes to and from the transceiver through a serial housing connector that provides RS232 communication between the transceiver and the Smart Hostess Board. A 50 pin round cable connector then takes the information to and from the Smart Hostess Board. This information is placed into shared RAM to be accessed by the 386DX CPU motherboard. Also connected to the Smart Hostess Interface Board is a watchdog timer. If a failure occurs that causes a communication problem between the hardware and software, the watchdog circuit will reset the system automatically.

5.2.3 DISK DRIVE CONTROLLER

The disk drive controller interfaces to the 3 1/2 inch, 1.44M byte disk drive(s) and the hard disk drive. The controller is clocked at 24MHz and provides necessary operating commands to the disk drives. A 34 pin ribbon cable connects the controller to the disk drives. The disk drive controller board also contains the parallel connector for the Printer option which is activated with special software.

5.2.4 RECORDER DATA INTERFACE CARD

The recorder data interface card gets recorder data from the 386DX CPU bus and converts the data to an X, Y, Z format that is then printed on the recorder strip. Time of day, month, year, alarm record or manual record as well as waveforms and parameters are documented on the strip. Operating voltages and strip data for the recorder, go through the dual 25 conductor interface cable.

5.2.5 SWITCHING POWER SUPPLY

The switching power supply is UL and CSA approved. A selectable input of 115V or 220V, should only be used in the 115V setting. The output voltages are +5V at 20A, +12V at 7.5A, -5V, and -12V at .5A. The switching power supply is fan cooled for maximum efficiency.

5.2.6 TRANSCEIVER

The transceiver can be broken into three sections: A transmitter, receiver, and a digital section. The digital section gets serial information in RS232 format from the Smart Hostess Board. The transceiver software dictates when the information will be transmitted.

The transmitter and receiver operate on FM/FSK modulation. Demodulation involves removing the FM carrier, leaving two subtones. These two subtones are then turned into a digital format, 1's and 0's, to go on to the digital section of the transceiver. Modulation is the reverse process of demodulation.

Transmission times can vary between 50ms to 200ms depending on what kind of parameters need to be sent.

5.2.7 POWER SAVE FEATURE

As a means to conserve battery power within the bedside monitor, MDE has designed a power save feature into the transceiver software. This feature has the ability to tell the RF section to power up, power down, transmit and receive.

With this power save feature, the transceiver located within the bedside monitor turns on the receiver only when it is expecting to receive timing instructions from the LINK Central Station. The transmitter is turned on only during the portion of the allocation frame when the central station is expecting to receive parameter packets and waveform packets from that bedside monitor. During all other portions of the allocation frame, the RF section is turned off.

When the bedside monitor goes out of range, the transceiver turns on the receiver section, three seconds out of every ten seconds. This is repeated until the bedside monitor receives a valid allocation packet from the LINK Central Station. Once an allocation packet is received, the bedside monitor will sync-up to the allocation frame and begin transmitting its parameter packets and waveform packets to the central station.

SYSTEM COMMUNICATION

CHAPTER 6

6.0.0 COMMUNICATION THEORY

6.1.0 COMMUNICATION OVERVIEW

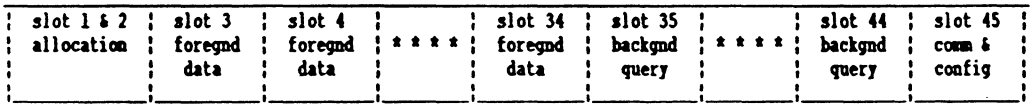
The communication between the LINK-ESCORT Bedside and the LINK Central Station, is through the transceivers. All communication is directed by software located within the LINK Central Station.

All communications between the bedside monitors and the LINK Central Station are organized into time periods called allocation frames.

Each allocation frame is 2.25 seconds in length and is composed of 45, 50ms slots. Each slot is 48 bytes long. At the beginning of each frame the LINK Central Station broadcasts instructions describing how the slots within that frame are to be allocated.

6.2.0 DESCRIPTION OF FRAME

The organization of one frame is depicted in the following illustration:


slot 1 & 2 allocation
slot 3 foregnd data
slot 4 foregnd data
* * * * *
slot 34 foregnd data
slot 35 backgnd query
* * * * *
slot 44 backgnd query
slot 45 comm & config

Slots one and two are allocation slots, which inform each bedside where to transmit their respective data packets in the allocation frame and what parameter/waveform data to transmit. Slots three through 34 are foreground data slots which contain packets of information describing parameter, status and waveform data from the bedsides, which are assigned on the LINK display. Slots 35 through 44 are background data slots which contain packets of information describing parameter information for the overview beds not displayed on LINK Central Station, but assigned in overview. Slot 45 is for communication and configuration only.

6.2.1 FOREGROUND AND BACKGROUND DATA SLOTS

Two types of remote communication exist on the network's foreground remote communication and background remote communication.

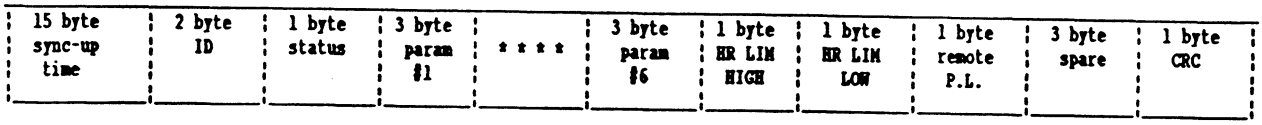
When a bed is assigned to overview on the LINK Central Station, all remote communications between the bedside monitor and the LINK Central Station are assigned within the allocation frame as background data. Background data slots may be filled with parameter packets only. Background slot assignments are dynamic, changing location within the frame from frame to frame. Up to 24 background remotes may be assigned, ten of which are allocated in each frame.

6.2.2 DATA PACKETS

Four types of data packets exist within each frame,which are, parameter packets, waveform packets, allocation packets, and communication configuration packets.

6.2.3 PARAMETER PACKETS

A parameter packet occupies one data slot, which is described in the following illustration:



The first 15 bytes of each packet are to sync-up the RF circuitry. The next two bytes are for the bedside monitor to identify itself by address within the network. The one byte status is used to communicate alarm condition i.e., alarm on, alarm off, alarm suspend, parameter alarming. Three bytes are used for each parameter to update parameter information. Up to six parameters can be monitored through the network. The next two bytes are bedside heart-rate limits. One byte is used to show signal power level from LINK to bedside monitor. One byte is used to okay a recording at the LINK Central Station from the bedside monitor. The last byte is a check sum.

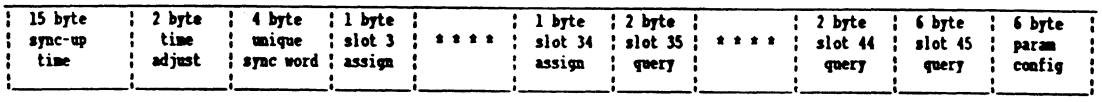
6.2.4 WAVEFORM PACKET

A waveform packet may follow a parameter packet in foreground slots and may be described as the following:

The first two bytes are for the bedside monitor to identify itself by address within the network and the waveform type. The next 135 bytes contain 2.25 seconds of compressed waveform information. One byte range limit for error correction of data of the same type which keeps the waveform information consistent.

6.2.5 ALLOCATION PACKET

Slots one and two in the frame are occupied by the allocation packet. The following illustration describes what data is contained in allocation packet:

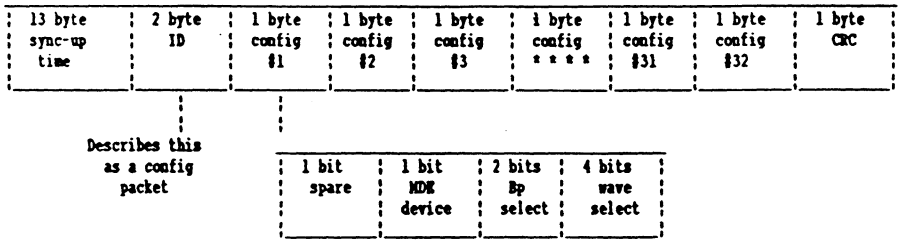

15 byte sync-up time
2 byte time adjust
4 byte unique sync word
1 byte slot 3 assign
* * * *
1 byte slot 34 assign
2 byte slot 35 query
* * * *
2 byte slot 44 query
6 byte slot 45 query
6 byte param config

The first 15 bytes are to sync-up the RF circuitry. The next two bytes are for time adjustment within the allocation frame. A unique four byte sync word is used to synchronize remotes. Slots three through 34 contain the one byte address of the bedside monitors to which the LINK is assigned. Slots 35 through 44 contain a two byte query for the bedside monitors assigned to overview. Slot 45 contains six bytes of configuration information.

6.2.6 COMMUNICATION CONFIGURATION PACKETS

The LINK assigns slot 45 for general configuration. This general configuration assignment is broadcast as a general configuration packet in slot 45.

See the following illustration for the specific structure of the configuration packet:


13 byte sync-up time
2 byte ID
1 byte config #1
1 byte config #2
1 byte config #3
1 byte config * * * *
1 byte config #31
1 byte config #32
1 byte CRC
Describes this as a config packet
1 bit spare
1 bit MDK device
2 bits Bp select
4 bits wave select

TROUBLESHOOTING GUIDE

CHAPTER 7

7.0.0 TROUBLESHOOTING GUIDE

This chapter presents a troubleshooting guide for potential technical problems. For additional service information, contact the MDE Technical Support Department.

WARNING!: Removing chassis covers will expose high voltage and a potential for shock. Only qualified personnel should attempt disassembly of LINK display or LINK base.

If for any reason, the cover needs to be removed from the LINK Central Station, please refer to chapter 8, Mechanical Disassembly.

NOTE: THE FAN LOCATED ON THE BACK OF ESCORT LINK BEDSIDE MONITORS IS TEMPERATURE CONTROLLED AND WILL TURN ON AND OFF WHEN NECESSARY.

7.1.0 NO DISPLAY

Is green indicator on?

If yes:
* Adjust contrast and brightness.
* Insure LINK base is "on".
* Check display cable connector to LINK base.
* Reseat VGA card in LINK base.

If no:
* Depress on/off switch at display. Is it engaged?
* Make sure AC power cord for display is plugged in.

7.2.0 CENTRAL STATION NOT BOOTING UP

Is green power indicator on?

If yes:
* Make sure software disk is installed, and reboot.
* Verify disk drive is operating (LED on).

OR

* If system has the Full Disclosure option, is the hard disk drive is being accessed (red LED above reset switch). Verify no floppy disk is installed in drive A:.

If no:
* Depress "power on" switch.
* Verify power cord for LINK base is plugged in.
* Insure switching power supply fan at the rear of the LINK base is running. This can determine if operating voltages are available.

7.3.0 DISK DRIVE NOT OPERATING

Is disk drive indicator on?

If yes:
* Insure software disk is certified MDE software.
* Remove disk, reinstall and reboot.

OR

* If system has the Full Disclosure option, verify no floppy disk is in the drive and reboot system.

If no:
* Verify ribbon cable is connected to disk drive and to disk controller PCBA.
* Reseat disk controller PCBA.

7.4.0 NO TOUCHSCREEN OR INACCURATE DATA INPUT

Run finger in a zig zag pattern near the bottom of the screen. Are any of the keys highlighted?

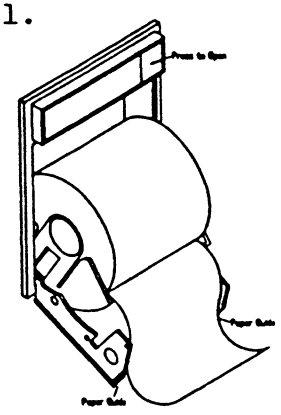
If yes:
* Recalibrate touchscreen from the angle the central station is to be operated from.
* Reseat touchscreen cable at LINK base.

If no:
* Reseat touchscreen cable at LINK base.
* Reseat touchscreen interface PCBA.

7.5.0 NO RECORDER STRIP

Is blank paper coming out of recorder?

If yes:
* Insure paper is not in backwards, reload paper. Paper should come from under the roll.



* Insure that correct paper is being used. Use only MDE approved paper that is 50mm in width and heat sensitive.

If no:

* Verify that there is paper in the recorder.
* Make sure the recorder door is closed.
* Verify that paper is properly loaded and not caught in the door.
* Insure recorder ribbon cable is connected.
* Reseat recorder interface PCBA.

7.6.0 COMMUNICATION PROBLEMS BETWEEN LINK CENTRAL AND BEDSIDE

When experiencing communication problems, the first thing to do is gather information. A good place to start is on the Power Level page on the LINK Central Station. The page can be read in the following manner:

* The numbers 1 through 32 indicate each individual bedside monitor.
* **POWER LEVEL AT REMOTE** indicates the signal strength that the bedside monitor is receiving from the central station.
* **POWER LEVEL AT CENTRAL** indicates the signal strength that the central is receiving from the bedside monitor.

For good communication the green bar should be at least at the half way mark.

Checking for off air interference should be done if there seems to be a communications related problem. To do so, turn off suspect bedside monitor. Using the Power Level page on the LINK Central Station, the green power level bar should be no more than 15% in amplitude.

Another troubleshooting tool is the green LED, COMM OK, at the front of the bedside monitor. If the LED is not on, there is no signal from the central being received. If the COMM OK is flashing, signal is being received from the central, but complete communication has not been established.

7.7.0 NO PATIENT WAVEFORM OR PARAMETER

Verify bedside monitor is turned "on".

Is the bedside monitor COMM OK LED flashing?

If yes:

* Verify bedside antenna is properly installed.
* It may be out of range.
* Check Power Level page (POWER AT CENTRAL) on central station.

If no:

* Check LINK Central Station antenna is properly connected.
* Assure LINK Central Station is configured to SEE bedside monitor. (See address on front of bedside monitor.)
* Verify bedside antenna is properly installed.
* Check Power Level page (POWER AT CENTRAL) on central station.

If bedside monitor COMM OK LED is on:

* Check configuration page to assure that tile is dedicated to bedside monitor.
* Be sure desired wave form is selected on display.

If more than one LINK Central Station Networks are in service, verify the bedsides being used correspond to the proper LINK Central Station Network. Each network is color coded.

MECHANICAL DISASSEMBLY

CHAPTER 8

8.0.0 MECHANICAL DISASSEMBLY

CAUTION: Only qualified (Authorized) personnel should attempt to perform repairs or remove any parts within this system. Opening the unit or removing the covers could violate the warranty.

8.1.0 SAFETY

Dangerous high voltage potentials are exposed when covers are removed. Remove AC power from instrument before servicing or removing covers. Always observe safe working techniques when troubleshooting or removing components.

NOTE: This system contains static sensitive circuitry. Use ESD precautions when handling electronic components and printed circuit board assemblies.

NOTE: When replacing PCBA's, refer to the Board Placement and Connector Placement diagrams at the back of this chapter.

LINK BASE <PC CPU> DISASSEMBLY

8.2.0 TOP COVER REMOVAL

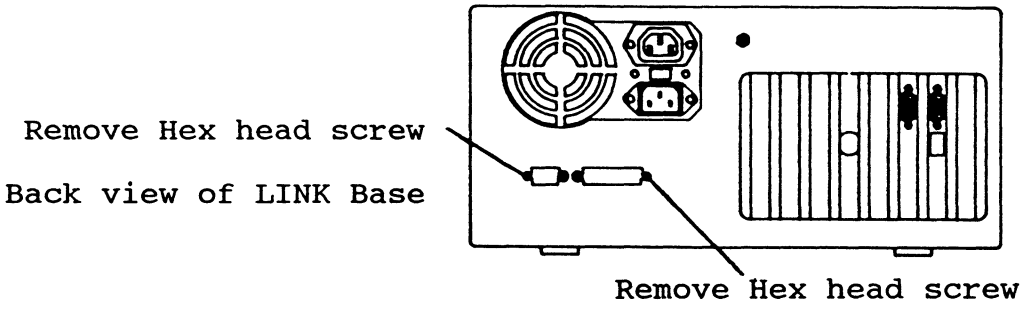
Remove one Phillips head screw from the top center of the back panel. Lift top cover up from rear and pull back until cover is free of front panel.

8.2.1 RECORDER REMOVAL

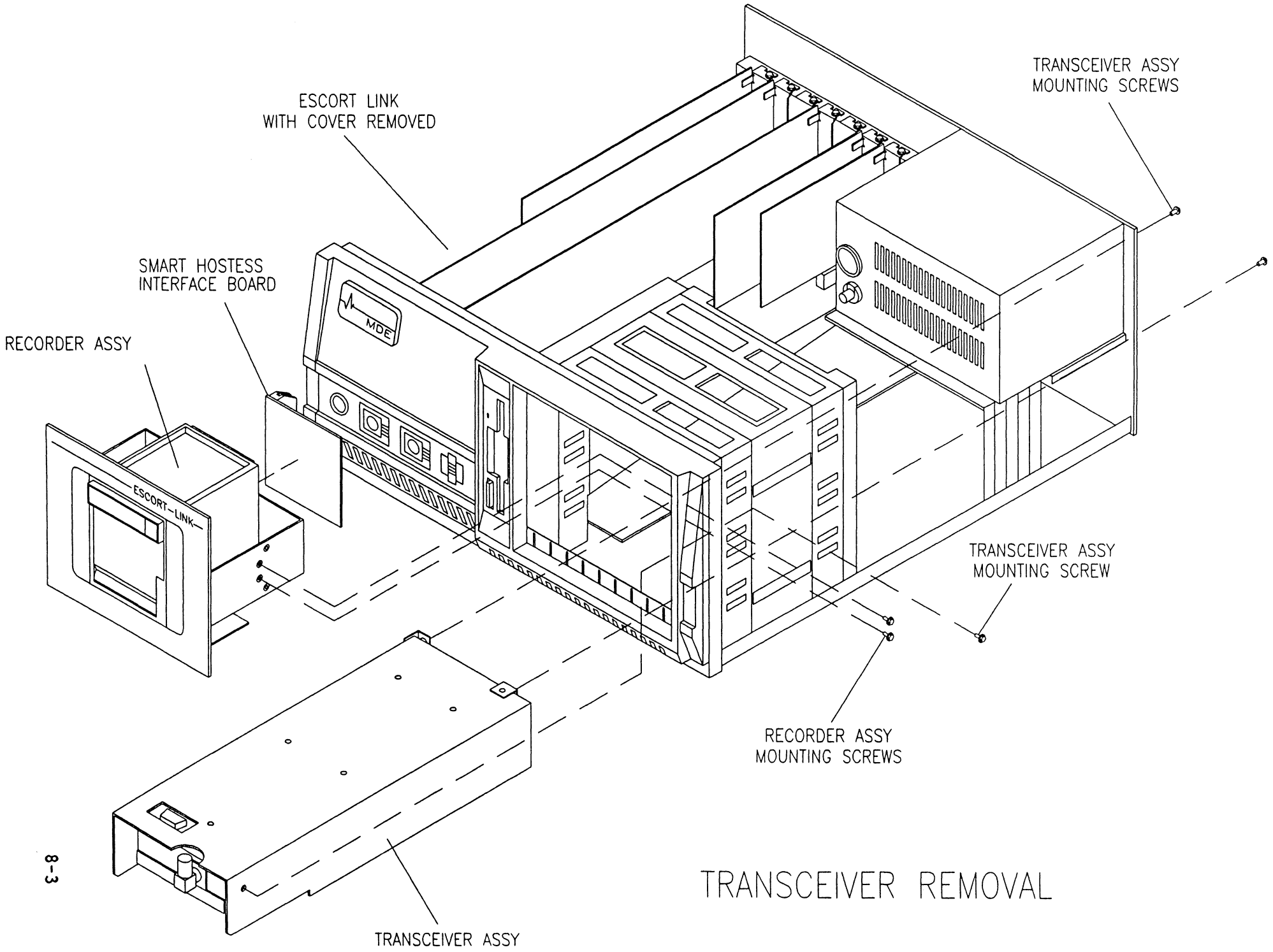
Remove two Phillips head #2 posi drive screws located on right side of LINK Base, vertically stacked one inch from front panel. Disconnect ribbon cable horizontally mounted at top rear of recorder. Disconnect cables from the Hostess Interface board. Slide recorder assembly out through the front panel.

8.2.2 TRANSCEIVER ASSEMBLY REMOVAL

Remove recorder as described in the previous step. Disconnect RG59/U antenna cable from transceiver (left front, BNC connector). Disconnect power supply cable, and the 9 pin D type connector mounted on left, front, top of transceiver. Remove #2 posi drive Phillips head screws located on right side of LINK Base, 4 inches back from front panel. Remove two Hex head screws mounted on rear panel of LINK Base (see drawing).



Slide transceiver assembly out the front panel through the vacant recorder housing.

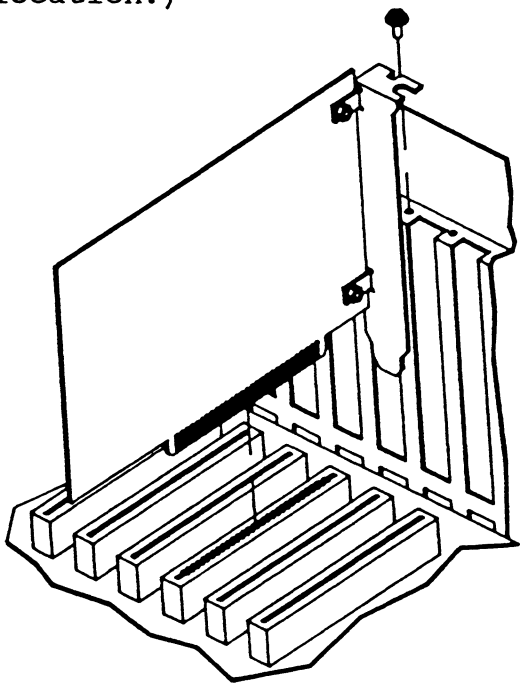


TRANSCEIVER REMOVAL

8.2.3 BASIC PCBA REMOVAL

CAUTION: Follow ESD precautions when handling PCBA's.

Removal of the VGA PCBA, touchscreen PCBA, Smart Hostess PCBA, disk control PCBA, and recorder controller PCBA may be accomplished as follows. Remove Hex head screw located on PCBA mounting bracket, attaching PCBA to the LINK base back plane (see illustration). Lift PCBA straight out with a slight rocking motion. (See illustration for PCBA location.)



8.2.4 FLOPPY DRIVE REMOVAL

Remove touchscreen controller PCBA and Smart Hostess PCBA, as described in the PCBA removal section. Remove two Hex head screws located on the top floppy drive mounting bracket. Remove one Hex head screw located on lower floppy mounting bracket. Disconnect vertically attached floppy drive ribbon connector and disconnect power supply connector. Slide floppy drive out through the front panel of the LINK base.

8.2.5 MOTHER BOARD REMOVAL

Remove VGA PCBA, touchscreen PCBA, Smart Hostess PCBA, disk control PCBA, and recorder controller PCBA, as previously mentioned in the Basic PCBA Removal section. Disconnect power supply connector J1. Remove three #1 posi drive Philip's head screws located near IC's U47, U53 & BATTERY 1. Slide motherboard to left of LINK Base about 1/2 inch. Carefully lift motherboard out of LINK Base.

8.2.6 MEMORY MODULE REPLACEMENT

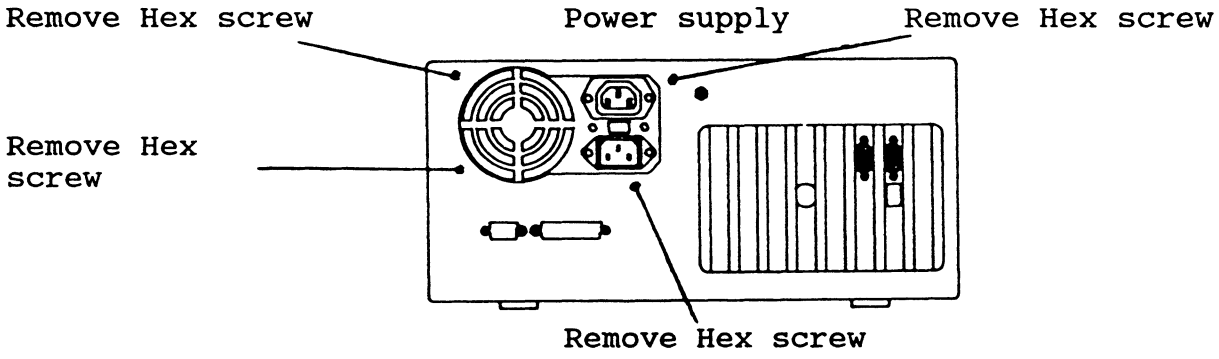
Memory modules are located on the motherboard and are labeled U38, U39, and U41 through U46. Remove VGA PCBA, touchscreen PCBA, Smart Hostess PCBA, disk controller PCBA and recorder controller PCBA as mentioned in the Basic PCBA Removal section. The memory modules are located next to the floppy drive and are SIMM socket mounted.

8.2.7 BIOS REPLACEMENT

The Bios EPROM is located on the motherboard U1. Remove motherboard PCBA as described previously in section 8.2.5. Using an IC extraction tool, remove the IC from the socket and install replacement noting proper orientation.

8.2.8 POWER SUPPLY REMOVAL

Disconnect all power supply cables. Remove four Hex head screws located on back panel of LINK Base (see drawing). Remove two Hex head screws located inside LINK Base on power supply mounting bracket. Lift power supply out of LINK Base.



LINK DISPLAY DISASSEMBLY

8.3.0 SWIVEL BASE REMOVAL

Remove swivel base by pressing down on the two tabs located at rear of the base, then slide backwards.

8.3.1 REMOVE DISPLAY FROM MAIN HOUSING

Remove four #2 Phillips head posi drive screws directly behind bezel. Remove one #2 Phillips head posi drive screw on rear panel near power input. Grip display by the front of bezel and pull display out of rear housing.

8.3.2 BEZEL ASSEMBLY REMOVAL

Remove four 5/16" Hex head screws from behind bezel assembly. Pull bezel away from CRT.

8.3.3 DEFLECTION PCBA REMOVAL

Disconnect connectors B2, B3, B5, B6, B7, and B8. Loosen 1/4" Hex head screw on CRT neck clamp located 1/2" from the back end of the CRT neck. Carefully pull deflection PCBA CRT connector free of the CRT.

8.3.4 TOUCHSCREEN REMOVAL

Using a razor knife, carefully cut the adhesive foam between the CRT and the touchscreen. Pull the touchscreen away from the CRT. Cut the ty-wrap securing the touchscreen cable to the back plane of the CRT and ty-wrap two inches below connector B2 on deflection PCBA.

8.3.5 CRT REMOVAL

WARNING: Implosion hazards exist when handling a CRT. Only qualified personnel should attempt the removal of a CRT.

Discharge the stored potential on second anode using a proper resistive shorting stick, and follow safe established procedures.

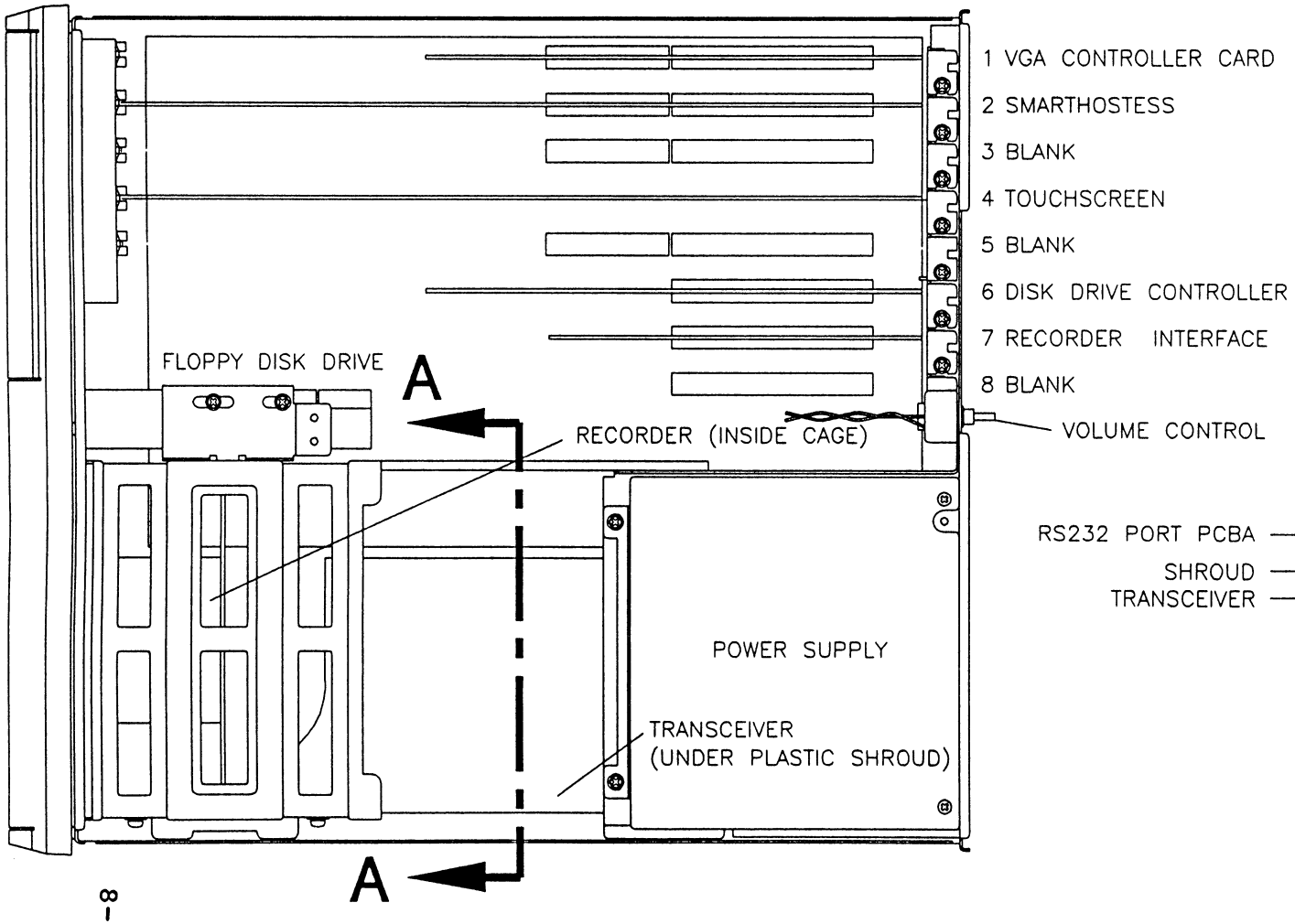
Remove deflection PCBA as previously described. Remove high voltage second anode lead from CRT.

CAUTION: Dangerously high voltage potentials may exist after unit is turned off and disconnected from power source.

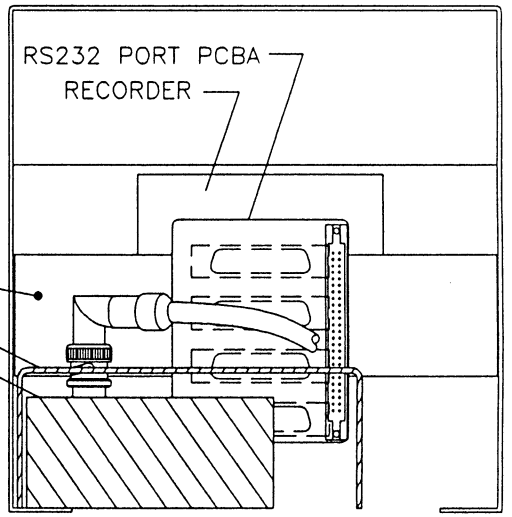
Loosen 1/4" Hex screw, securing yoke assembly. Slide yoke off neck of CRT. Slide CRT through mounting shroud.

8.3.6 REMOVAL: POWER SUPPLY AND MAIN PCBA

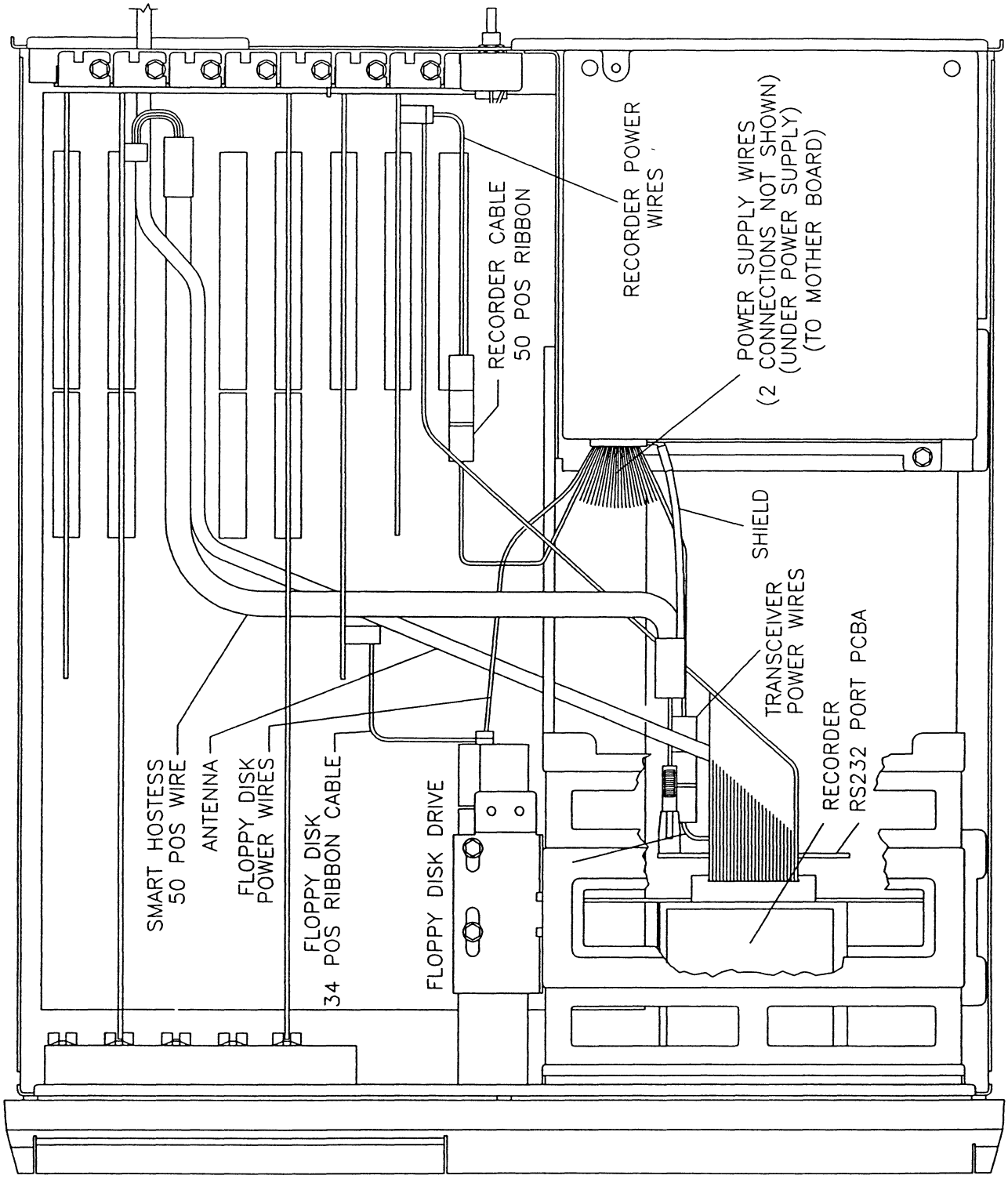
Remove deflection PCBA and CRT as previously described in this section. Remove #2 Phillips head posi drive screw, securing fly back transformer housing to bottom case. Disconnect connector D2 from main PCBA. Depress four PCBA's securing tabs lifting main PCBA above tab.



PCBA PLACEMENT



SECTION A-A



CABLE CONNECTIONS

ESCORT LINK OPTIONS

CHAPTER 9

9.0.0 ESCORT LINK CENTRAL STATION OPTIONS

9.1.0 ARCHIVE OPTION

Available with the LINK Central Station is patient data archiving. This is achieved with the installation of a second 3.5" 1.44M byte floppy disk drive and additional software. This second drive is connected internally to the 34 pin ribbon cable coming from the disk drive controller PCBA. Data received from the bedside monitors is loaded into system RAM where it is processed and saved to the archive diskette. Each sample represents a ten second interval and 24 hours of up to 6 parameters per patient can be stored.

9.1.1 EXTERNAL PRINTER OPTION

With the Printer option, the parallel port on the LINK Central Station is activated and configured for an HP IIIP Laser Printer. With this option, hard copies of patient trends and archive data can be created for further analysis and easier, permanent storage. Also, the printer can be used to print 24 hour patient waveforms if your system is configured with the full disclosure option.

9.1.2 ARRHYTHMIA MONITORING OPTION

The arrhythmia option is available in single increments from 1 to 8 channels. Events such as asystole, vfib, missed beats, run, couplet, high and low rate, high abnormal count, tachy, bigeminy, trigeminy, and slow run can be detected, labeled, saved, and printed. Note that the ECG waveform must always be displayed at the central station before arrhythmia monitoring capabilities can be activated.

Hardware required for the arrhythmia option is installed at the MDE factory with every LINK CENTRAL STATION. 8M bytes of dynamic RAM are used to store the system programs, arrhythmia templates, and information packets received from the bedsides.

Arrhythmia processing software is loaded from the 3.5" floppy disk unless your system is also configured with full disclosure. With the full disclosure option, software will be loaded from the hard disk. Packets received from the bedside monitors are loaded into RAM where they are processed. From this processing, waveform and supplemental information, such as time & date stamp, alarm status, beat type, and arrhythmia annotation are separated. ECG waveforms are then compared to template waveforms. The arrhythmia algorithms are heuristic, allowing the system to learn current patient trends for increased detection ability. From these comparisons, arrhythmias can be detected, categorized, alarmed, and recorded on a strip. The strip will annotate the date, time, and type of arrhythmia that occurred as well as tabular data of all available parameters of the patient.

Event history, an additional feature with the arrhythmia option, saves the last 100 ectopic events in system RAM with an event number, time and date stamp, and event class. Also available with each event saved, is 20 seconds of waveform data showing the 12 seconds of data preceding the incident and 8 seconds after. Since these events and waveforms are stored in RAM, they will be lost if power to the LINK is removed. Event history becomes active when arrhythmia is on, and provides event history for each arrhythmia channel separately.

9.1.3 FULL DISCLOSURE OPTION

If your system is equipped with the Full Disclosure option, a 200M byte hard disk drive will be used to store desired waveforms for up to 8 patients for a 24 hour period. Every 30 seconds, the hard disk is updated with the latest information received from the bedside monitors. Information, such as waveform data, time, heart rate, and abnormal beat counts are extracted from the processed bedside packets. The information is combined and stored to the hard disk. 3 packets from up to 8 bedsides equals a maximum of 24 packets saved to disk every 30 seconds.

Waveforms can be printed, with the printer option, in either 1 hour of waveform per page format or in the standard 25mm/second scale showing 50 seconds of waveform information. The 1 hour of waveform printouts show the date, time, average heart rate, and the number of abnormal beats in each of the 30 second intervals as well as the type of abnormal beat that was detected. The 50 second waveform page displays the waveform with a 25mm/second grid background. The page is laid out with 5, 10 second strips each displaying the date and time of the event being printed.

Waveforms can also be printed with the thermal recorder from the 24 hour waveform page selectable with either 20 or 80 seconds of data. The annotation on the strip depicts the date and time of the event as well as tabular data on all patient parameters connected at the time the data was saved.

SPARE PARTS LIST

CHAPTER 10

SPARE PARTS LIST

LINK DISPLAY WITH TOUCHSCREEN	401184
RECORDER	366000-0015
TRANSCEIVER	500107
SWITCHING POWER SUPPLY	366000-0037A
FLOPPY DISK DRIVE	366000-0020A
ANTENNA FOR CENTRAL STATION	401202
VOLUME CONTROL SWITCH ASSEMBLY	401330
HARD DISK 200 MB	366000-0033

PCBA'S

SMART HOSTESS INTERFACE	401187
TOUCHSCREEN CONTROLLER	401186
386DX MOTHERBOARD	401798
VGA CONTROLLER	401309
DISK DRIVE CONTROLLER	401856
RS232 PORT	401189
RECORDER INTERFACE CONTROLLER	401192

CABLES

RECORDER POWER CABLE	401193
RECORDER DATA CABLE	401194
RS232/TRANSCEIVER POWER CABLE	401196
ANTENNA CABLE	401204

NOTE: PLEASE CALL MDE TECHNICAL SUPPORT DEPARTMENT FOR PARTS INFORMATION AND ORDERING.

OPERATOR'S MANUAL

ESCORT-LINK E3200A
CENTRAL STATION

OPERATOR'S MANUAL

August 1993

Caution: Federal law (U.S.) restricts this device
to sale by or on the order of a physician.
This device is NOT for home use.

MEDICAL DATA ELECTRONICS
12720 Wentworth Street
Arleta, CA 91331-4309

(818) 768-6411
(800) 237-5243

NOTICES

This document provides you with details for setup and operation of the **ESCORT-LINK** Central Station. Read this Operator's Manual carefully before attempting clinical use of the **ESCORT-LINK**.

While reasonable efforts have been taken in the preparation of this manual to ensure its accuracy, the manufacturer and distributor assume no liability resulting from any errors, omissions, or use of any information this manual contains.

The **E3200A ESCORT-LINK** Central Station and **ESCORT 100** and **100T** bedside monitors are products of Medical Data Electronics, Inc.

Agency Approvals

This **ESCORT-LINK E3200A** has received the following certifications:

AGENCY	STANDARDS
UNITED STATES	UL 1950, FCC 90.217
CANADA	CSA
INTERNATIONAL	IEC 950

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HP LaserJet IIIP is a product of Hewlett-Packard Company.

Software and Documentation Updates

Periodically updates are made to software. If these revisions require an update to documentation, the updated documentation pages or manual will be supplied with the new software. Always update your Operator's Manual by inserting the new pages and discarding the old ones.

Related Books and Educational Material

- **ESCORT-LINK** Service Manual
- **ESCORT-LINK E3200A** Inservice Video
- ***ESCORT 100/200*** and ***100T/200T*** Operator's Manual
- ***ESCORT 100*** **AT-A-GLANCE** Reference Cards
- ***ESCORT 100*** Service Manual
- ***ESCORT 100*** Inservice Video

Customer Service

If you experience any problems with this product, or would like more information about related equipment, please call 1-800-237-5243 (toll free within the United States) or 818-768-6411. Requests can also be FAXed to 818-768-0759. Written requests for information should be addressed to:

MEDICAL DATA ELECTRONICS
12720 Wentworth Street
Arleta, CA 91331-4309

WARRANTY

The **ESCORT-LINK E3200A** Central Station is warrantied against defects in materials and workmanship for the period of twelve (12) months from the date of shipment to original purchaser. Batteries, cables, cuffs,and sensors are warrantied for a period of three (3) months form the date of shipment to original purchaser. Warranty is valid to the original buyer only. Defective equipment should be returned freight prepaid. Equipment returned with defective parts and assemblies will either be replaced or repaired. This warranty is not applicable if repair has been attempted, or if the instrument has been damaged due to operation outside the environmental and power specifications for the product, or due to improper handling or use.

If any fault develops, notify Medical Data Electronics, making sure to give full details of the difficulty, and to include the model and serial number of the device. Upon receipt of the shipping instructions, forward the device, prepaid, and repairs will be made at the factory. If the device is not covered by warranty, an estimate will be made before work begins, if requested.

The foregoing warranty is in lieu of all other warranties expressed or implied, including, but not limited to any implied warranty or merchantability, fitness, or adequacy for particular purpose or use. Medical Data Electronics shall not be liable for any special, incidental or consequential damages.

WARNINGS AND SAFETY CONSIDERATIONS

Read this manual carefully before attempting clinical use of the **ESCORT-LINK E3200A** Central Station. Additional warnings and cautions are included in appropriate sections.

WARNING: The ESCORT-LINK Central Station is intended only as an adjuct in patient assessment. It must be used in conjunction with clinical signs and symptoms.

WARNING: Carefully read this operator's manual, accessory directions for use, and all precautionary information (which is set in boldface type) before use.

WARNING: DO NOT plug unit into multiple outlet power strip to avoid summation of leakage currents.

WARNING: Explosion hazard. Do not use the ESCORT-LINK in the presence of flammable anesthetics.

WARNING: Never remove the ESCORT-LINK enclosure panels since dangerous high voltage would exposed. Always refer servicing to qualified personnel.

WARNING: In the event of adverse patient condition, the audio alarm will not sound if it has been temporarily silenced or disabled.

WARNING: The system cannot replace skilled nursing care and proper surveillance. Keep high-risk patients under close surveillance.

WARNING: For pacemaker patients, the HR detector may continue to count the pacemaker artifact during cardiac arrest or some other arrythmias. Keep pacemaker patients under close surveillance.

WARNING: DO NOT use in ambient temperature above 40° C.

WARNING: The ESCORT-LINK Central Station and antenna system should be installed and serviced by qualified MDE Service Technicians only.

WARNING: The ESCORT-LINK emits radio frequency energy every 2.25 seconds. When patient monitoring cables from other instruments are placed in close proximity to the transmitting antenna, enough energy may be received to produce an artifact on waveform monitors. During installation, check for artifact production on any nearby instruments. If any periodic artifact is observed, turn off the radio interface and contact MDE's Technical Service Department.

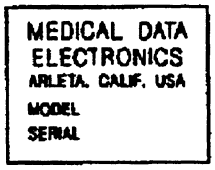
WARNING: Use an uninterruptable power supply in line between the ESCORT-LINK Central Station base unit and the AC power source to prevent loss of information in the event of a power outage or power surge.

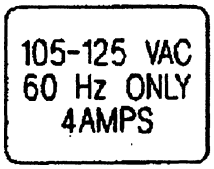
WARNING: Refer to Section 5, "Troubleshooting," in this manual for suggested action to alleviate a problem.

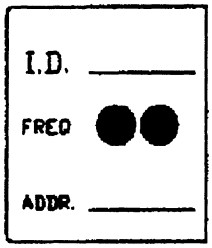
WARNING: Position the ESCORT-LINK Central Station in a well-ventilated area to ensure proper air flow and cooling.

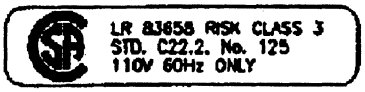
REAR PANEL LABELS

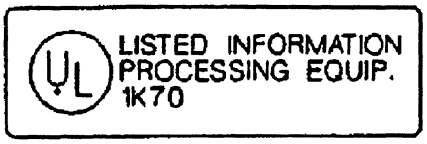
110 V 60 Hz



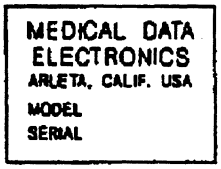


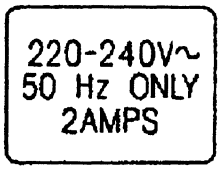


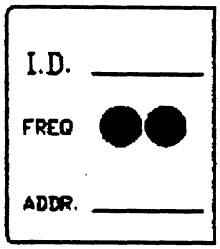




220-240 V 50 Hz







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1. INTRODUCTION

This Operator's Manual provides setup and operational information for the **E3200A ESCORT-LINK** Central Station manufactured by Medical Data Electronics. The user should be familiar with standard medical practice concerning patient care and patient monitoring procedures.

The **ESCORT-LINK** ....is a wireless, digital network providing centralized surveillance and documentation of up to 32 ESCORT portable bedside monitors.

The ESCORT bedside monitor houses a transceiver which exchanges information with another transceiver in the Central Station. A short transmitting/receiving antenna with a twist-on BNC connector is located on the top of the bedside monitor.

The **ESCORT-LINK** ... provides radio frequency communication in the UHF frequency band.

The **ESCORT-LINK** operates on a factory-configured frequency which is not already in use at the installation site. All FCC licensing and required frequency coordination checks are performed by MDE before each installation in the United States.

The power level of the ESCORT-LINK transmitters is 50 milliwatts, which is several times greater than ambulatory ECG telemetry transmitters. This allows for a longer range transmission and a simpler antenna system. An indicator on the ESCORT monitor illuminates when a communication link is established with the Central Station.

The **ESCORT-LINK** ... .digitally transmits data between the specially configured ESCORT bedside monitors and the Central Station.

Data, formed into packets of information and checked for validity before being processed at the Central Station, is transmitted to and from each ESCORT in the network. All ESCORTS exchange data with the central station every 2.25 seconds, so that only the most current information displays at the Central Station.

The **ESCORT-LINK** .... consists of a 386 computer and a VGA display, referred to collectively, as the central station.

The computer, or base of the Central Station, has several special function circuit boards in addition to a communications transceiver (as used with the bedside units). The base unit has a configuration mode to permit customized display formats which are set up initially by qualified personnel, then stored on disk and accessed by the unit at power-up.

The **ESCORT-LINK** .... uses a touchscreen to provide operator interaction, eliminating the need for an external keyboard.

The touchscreen provides a safe, reliable method through which to interact with the system. Selections are made from a menu located at the bottom of the screen. Prompts and messages appear as reminders when necessary.

The **ESCORT-LINK** .... provides a built-in thermal array recorder to document manual and alarm recordings and tabular vital signs.

Manual or alarm recordings of waveform and tabular vital sign data can be generated when a waveform is displayed at the central station. When no waveform is displayed at the Central Station, the tabular vital sign data is recorded.

The **ESCORT-LINK** .... provides Event History in which user-selected events are automatically stored.

Up to 100 abnormal events per patient are stored in memory. Events can be reviewed, cleared, or documented on a thermal array recorder.

The **ESCORT-LINK** .... offers Arrhythmia as an option available in single channel increments.

Arrhythmia processing provides up to eight arrhythmia channels assignable to any of the patients monitored on the system. Rate, rhythm, and morphology abnormalities are detected.

The **ESCORT-LINK** .... offers a Full Disclosure option for waveform storage and review.

Full Disclosure provides 24 hour storage and quick access to all waveforms displayed at the Central Station. The optional Hewlett-Packard LaserJet IIIP documents compressed one hour pages.

2. GETTING STARTED

WARNING: The ESCORT-LINK Central Station is intended for use as an adjunct in assessing a patient's condition. The ESCORT-LINK must be used in conjunction with assessment of a patient's clinical symptoms.

WARNING: Carefully read this Operator's Manual before attempting clinical use of the ESCORT-LINK Central Station.

The **ESCORT-LINK E3200A** Central Station consists of a computer screen and computer base with an integral single channel recorder.

The **ESCORT-LINK** displays data as a central monitoring station for as many as 32 **ESCORT 100** or **100T** bedside monitors. Each bedside monitor is factory configured with a transceiver interface to communicate through radio frequency with the Central Station.

Vital sign information, including waveforms, parameter values, and alarm status, is available for display at the Central Station. The Central Station screen is configurable during system setup, and can be reconfigured if more monitors are added or patient monitoring needs change. The Central Station touchscreen provides an interface between the operator and the system for all clinical monitoring needs.

Visual and audible alarms are available for all monitored parameters both at the bedside and at the Central Station, and settings can be tailored to the individual patient's condition. Up to 100 abnormal events per patient are stored in Event History where they can be reviewed, cleared, or documented. The integral thermal array recorder provides alarm and manual recordings of parameter data and waveforms.

Arrhythmia processing is available as an option to provide up to eight arrhythmia channels assignable to any patient monitored by the **ESCORT-LINK** system.

Full Disclosure option provides 24 hour storage and quick access to up to 8 patients' waveforms displayed at the Central Station.

Parameter values are automatically trended for up to 24 hours, and optional Data Archive allows diskette storage of all trend data.

The optional Hewlett-Packard LaserJet IIIP prints Full Disclosure information and Trend Plots.

Table 2-1 lists all options which are available for the **ESCORT-LINK E3200A** Central Station.

Option	Description
15L	Archival Data Storage—3.5" diskette
16L	Trend Printer (Hewlett-Packard LaserJet 111P)
23L	Arrythmia Channel (order must specify quantity 1-8)
24L	Full Disclosure, 8 patients

Table 2-1. ESCORT-LINK Central Station Options

2.1 SYSTEM DESCRIPTION

The controls and indicators for the **ESCORT-LINK** Central Station are located on the base unit and touchscreen.

The touchscreen on the **ESCORT-LINK** displays vital sign information processed by the bedside monitor and transmitted to the Central Station. The data appears in the form of symbols, waveforms, and brief messages. These messages relate to system operation, monitoring parameters, operator prompts and reminders, and error conditions.

Familiarize yourself with these controls before attempting clinical use of the system.

2.1.1 Front Panel

Figure 2-1 identifies front panel controls and indicators.

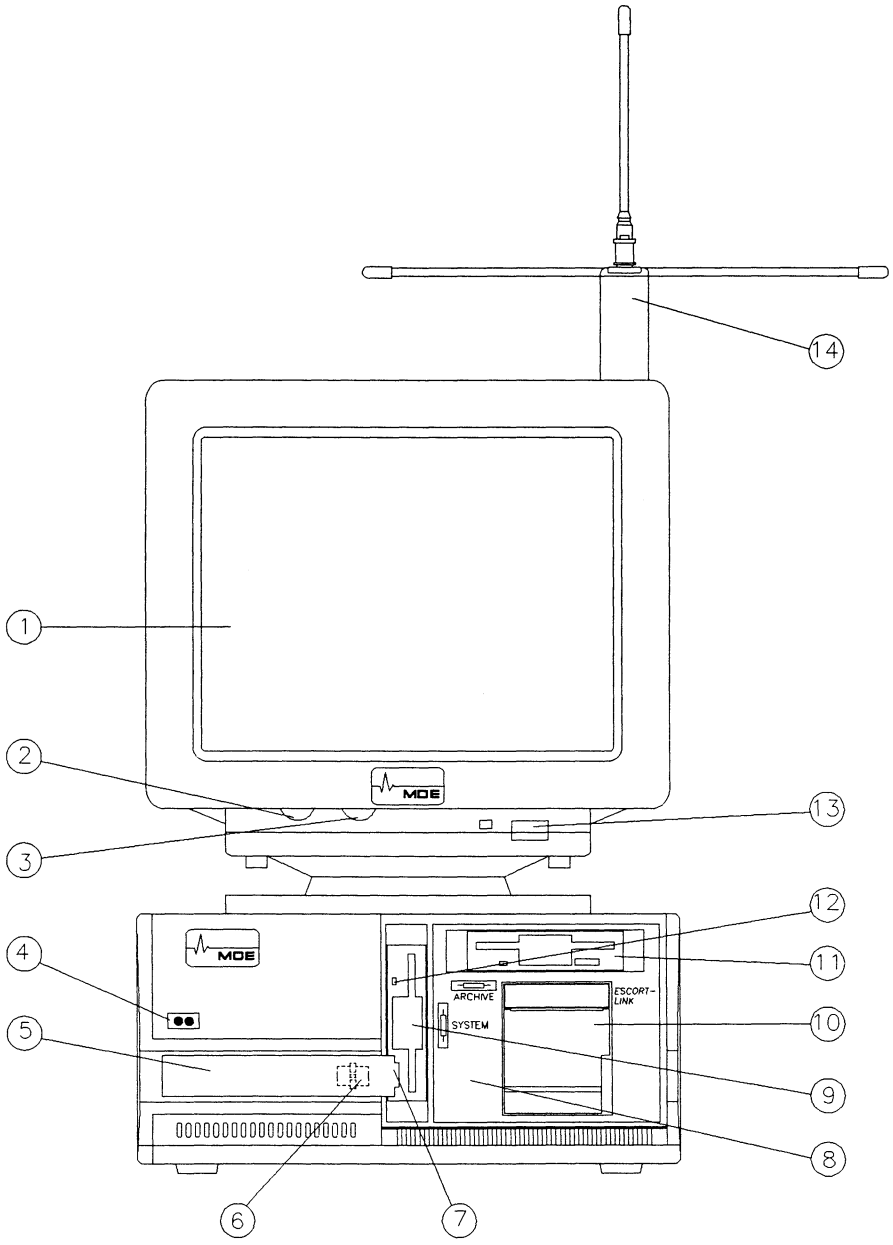


Figure 2-1. ESCORT-LINK Front Panel

1. **Screen:** displays all patient waveform, parameter, and alarm information as well as touchscreen controls and messages.

2. **Brightness Control**: turns to adjust screen brightness.

3. **Contrast Control**: turns to adjust screen contrast.

4. **ID Tag**: uses color coding to identify the frequency of the system.

5. **Safety Cover**: slides to protect the reset button, power on/off switch, hard disk drive indicator, and system diskette release switch to prevent accidental access to these controls.

6. **Hard Disk Drive Indicator**: illuminates when the system accesses the hard disk drive, a function of the Full Disclosure option.

7. **Base Power On/Off Switch and Indicator**: toggles the power on or off to the base unit. When ON, the indicator illuminates, and the button is depressed. When OFF, the indicator is not lit, and the button is flush with the front panel.

8. **System Diskette Release Switch**: releases the diskette located in the adjacent drive when pressed.

9. **System Diskette Drive**: used for system configuration data and system program disk. When configured with the optional Full Disclosure hard disk drive, the System Drive is used only to load software updates.

10. **Recorder**: provides manual or alarm recordings of waveform and parameter data.

11. **Archival Diskette Drive (optional)** allows storage and retrieval of trend data.

12. **System Diskette Drive Access Indicator:** illuminates when information is being read from or written to the system diskette.

13. **Screen On/Off Switch and Indicator**: toggles the power on and off to the screen. Push to turn ON, and the indicator illuminates; push to turn OFF, and the indicator is no longer illuminated.

14. **Antenna:** transmits and receives data between the Central Station and the bedside monitors.

2.1.2 Rear Panel

Cables connect the central processing unit with the screen on the rear panels of each. Cable connections, power connections, and rear panel controls are shown in Figure 2-2.

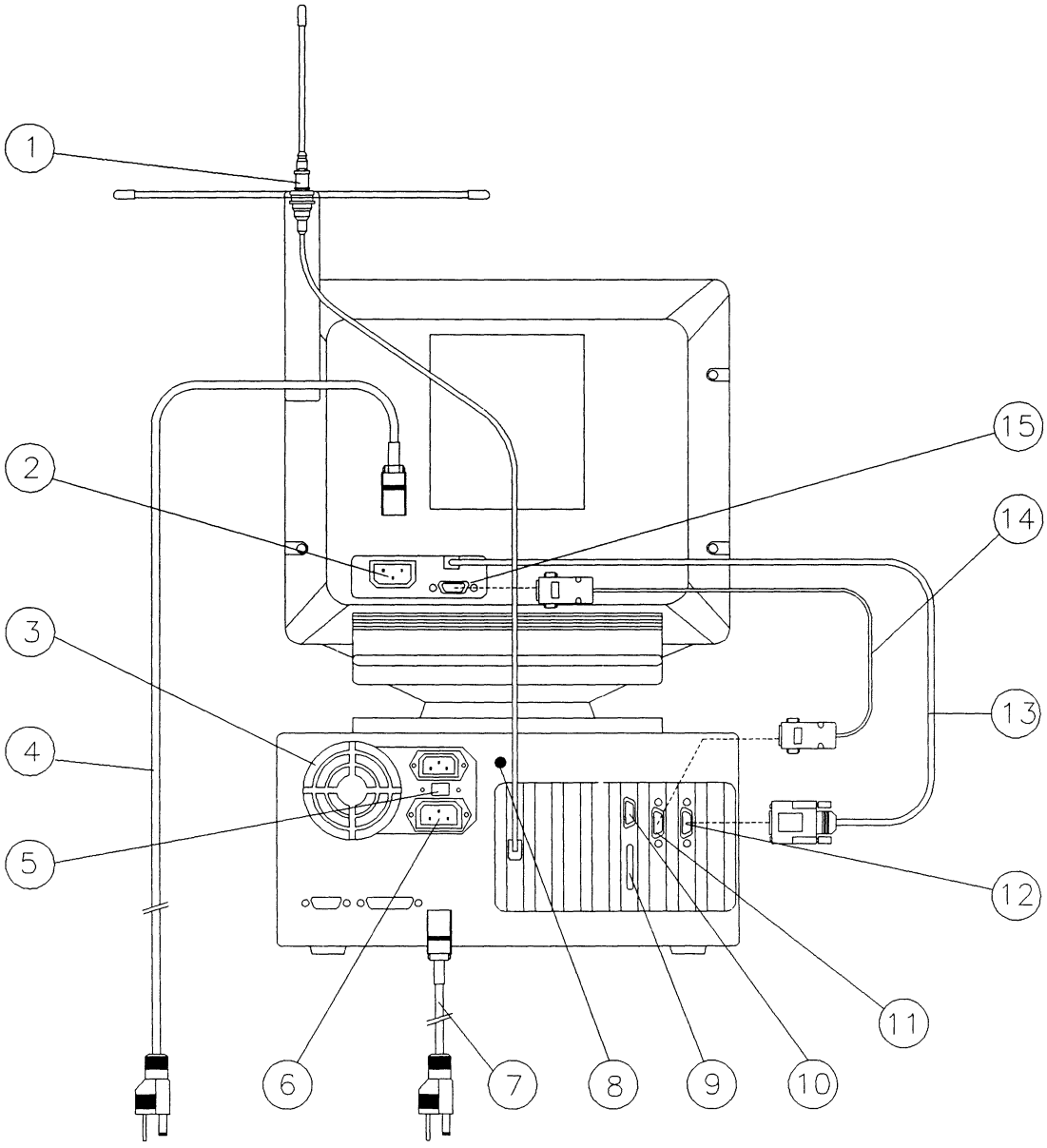


Figure 2-2. ESCORT-LINK Rear Panel

1. **Antenna:** transmits data between the Central Station and the bedside monitors.
2. **AC IN:** connects display to AC power.
3. **Fan:** cools the base unit.
4. **Screen Power Cord:** connects the display to the AC power source.
5. **110/220 Voltage Switch:** toggles between 110 Vac and 220 -240 Vac.
6. **AC IN:** connects the base unit to the AC power.
7. **Base Unit Power Cord:** connects the base to the AC power source.
8. **Audible Alarm Volume Control:** turns to adjust alarm volume.
9. **HP LaserJet Connector:** connects the Printer Interface Cable (optional) to the base unit.
10. **RS232 Out:** serves as a gateway into a Clinical Information System.
11. **Touchscreen Connector:** connects the Touchscreen Cable to the base unit.
12. **Video Connector:** connects the Video Display Cable to the base unit.
13. **Video Display Cable:** transfers information from the base unit to the screen for viewing.
14. **Touchscreen Cable:** provides touch sensitive interface with the screen.
15. **Touchscreen Connector:** connects the Touchscreen Cable to the screen.

2.1.3 ESCORT Bedside Monitor

The **ESCORT-LINK** Central Station communicates with each **ESCORT 100** or **ESCORT 100T** portable bedside monitor that is configured to the same frequency. Color-coded identification tags label each Central Station and bedside monitor frequency.

Communication is automatically established between the bedside monitor and the Central Station. Confirmation of transmission is indicated at the bedside as well as at the Central Station.

Figure 2-3 identifies the frequency ID tag and the communication indicator on the **ESCORT 100** or **ESCORT 100T**.

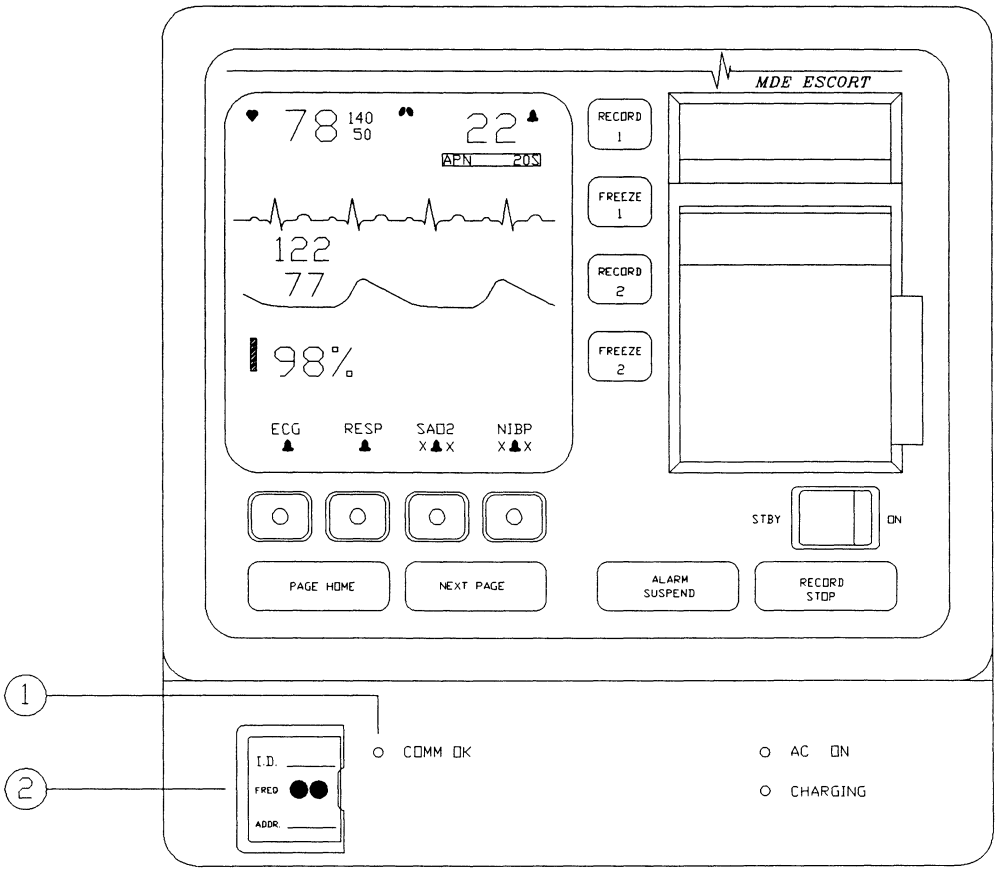


Figure 2-3. ESCORT Bedside Monitor Front Panel

1. **COMM OK Indicator:** illuminates when bedside monitor and Central Station are communicating. It stays on for as long as communication is established. A flashing light or no light indicates that communication is not established.

2. **ID Tag:** identifies the monitor ID number, the monitor to address (1-32), and the transceiver frequency color code. The frequency color code is important if more than one Central Station is in use, since it distinguishes the bedside monitors that communicate with a particular Central Station.

Consult the ESCORT 100/200 and ESCORT 100T/200T Operator's Manual for complete operational instructions.

2.2 TURN ON THE SYSTEM

1. Tilt the touchscreen to the desired viewing angle (within 90° horizontally and 13° vertically).

2. Insert the **ESCORT-LINK** system diskette (metal edges forward and label to right) into the System Drive until there is a "click" sound, and the Diskette Release Switch extends.

CAUTION: Do not remove the system diskette while the ESCORT-LINK is in operation.

NOTE: When Full Disclosure option is installed in the system, the system program resides on the hard disk drive instead of the floppy diskette drive.

3. Press Screen ON/OFF, and confirm that indicator is ON.

4. Press **ESCORT-LINK** Central Station Base Power Switch, and confirm that indicator is ON.

WARNING: When the system reboots, Central Station monitoring surveillance is suspended for approximately 15 seconds if the system includes a hard disk drive. If the system contains no hard disk drive, monitoring surveillance is suspended for approximately 2 minutes.

The system goes through a series of brief self-tests and displays the start-up screen (Figure 2-4). As the ESCORT-LINK programs initialize, the diskette drive indicator lights up; the start-up screen prompts you either to calibrate the touchscreen, or wait for the main monitoring screen to display.

NOTE: Calibration is normally required only once during initial setup; however, if screen responses to a touch are "out of alignment", then recalibrate the screen.

5. To access the calibration screen, touch the display as directed.

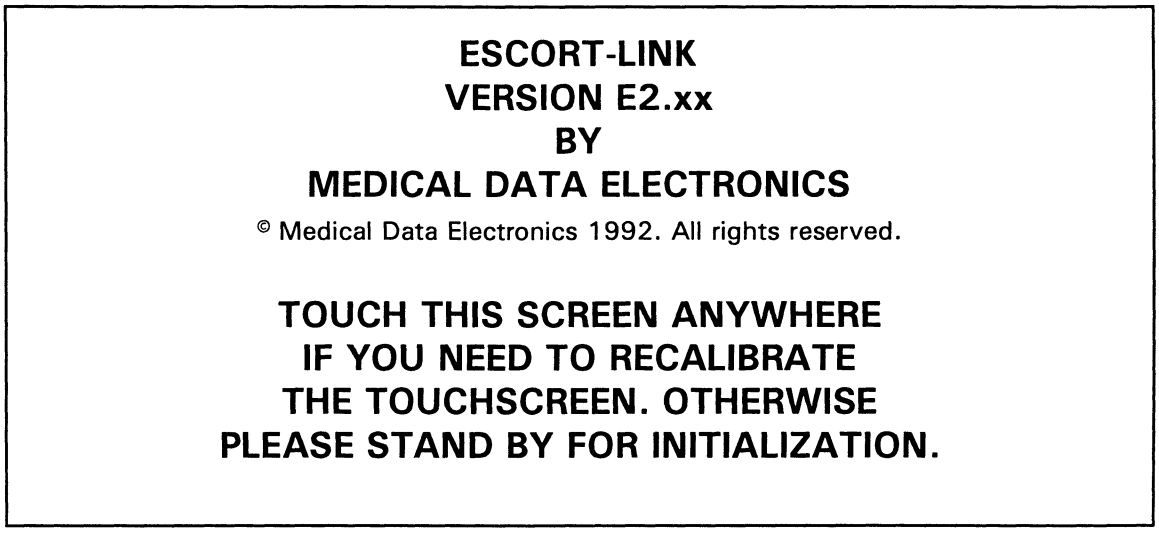


Figure 2-4. ESCORT-LINK Start-Up Screen

6. To recalibrate the screen, touch each of the three calibration points which are displayed. A message, "OK", displays after each selection.

7. Confirm that the system is configured correctly before continuing. See *Section 6, "System Setup,"* for instructions on configuring the system.

A **No Comm** message in the parameter tile(s), and **OFF** on the patient line(s) in the *Overview* tile on the display, as shown in Figure 2-5, indicates that the communication link with the ***ESCORT*** monitors has not yet been established.

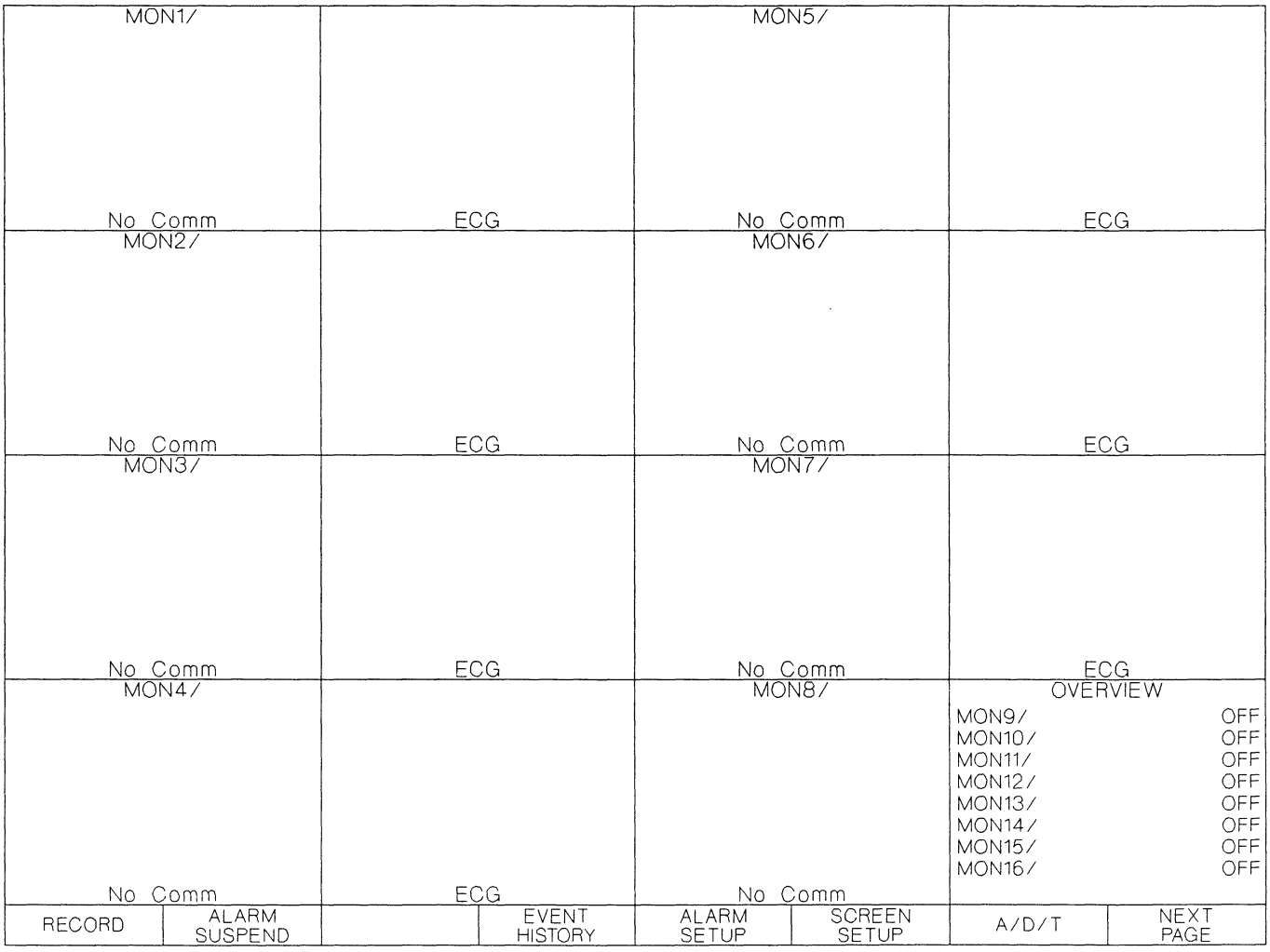


Figure 2-5. Main Monitoring Screen

Each Central Station and bedside monitor is configured at the factory to communicate via a specific frequency. The frequency of each is identified through a color-coded ID tag. Although there are over 50 frequencies used in the **ESCORT-LINK** system, Table 2-2 defines the most commonly used frequencies with their associated color codes and channels.

Color	Frequency	Channel
Blue/Black	464.7875 MHz	7
Red/White	462.7625 MHz	8
Yellow/Black	463.7625 MHz	10
Yellow/White	464.6875 MHz	13
Green/White	464.9875 MHz	14
Blue/White	464.8875 MHz	20
Red/Gray	457.6000 MHz	22
Orange/Orange	467.7500 MHz	23

Table 2-2. ESCORT-LINK Color-Coded Frequencies

2.3 START-UP PROCEDURES

2.3.1 Display Tiles

The **ESCORT-LINK** Central Station is operated through use of the touchscreen display. The display consists of 16 information tiles and 8 menu keys, as shown in Figure 2-6.

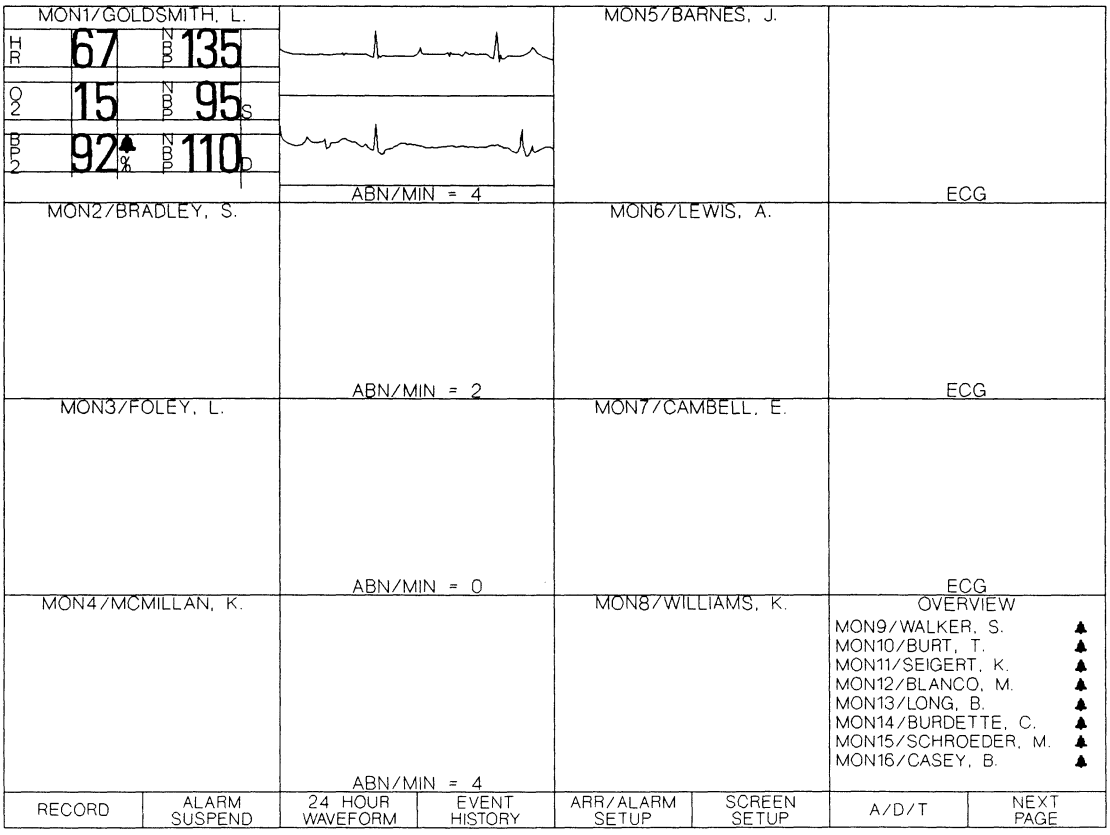
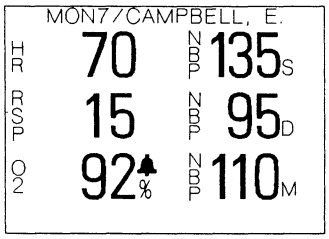


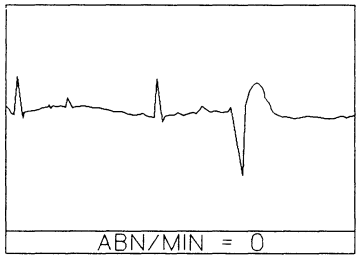
Figure 2-6. ESCORT-LINK with Arrythmia Main Monitoring

1. Parameter Tile
2. Monitor/Patient ID
3. Waveform Label
4. Parameter label
5. Waveform Tile
6. Overview Tile
7. Alarm Status
8. Menu Keys
9. ABN/MIN Count
10. Event Time Stamp
11. Message Field
12. Arrythmia Waveform Tile
13. Split Screen Arrythmia Waveform Tile

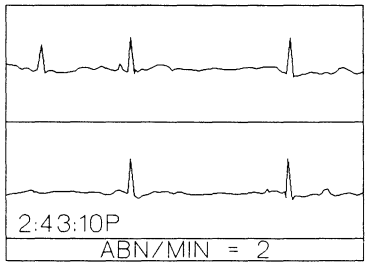


Parameter Tile displays up to six parameter values, alarm status, advisory messages, and monitor/patient ID associated with a particular patient. A 16-character ID field above each parameter tile identifies monitors and patients.

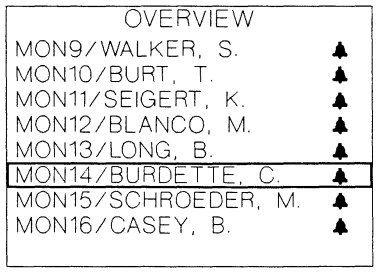
Waveform Tile displays a 2.5 second waveform for the parameter tile located immediately to its left. The label at the bottom identifies the waveform. Wave-form length can be extended to include 2 or 3 adjacent waveform tiles, which provide a total of 5 or 8 seconds of waveform, respectively.



Arrhythmia Waveform Tile displays a 2.5 to 8 second waveform. The Abnormal Beats per Minute count (ABN/MIN) replaces the waveform label. This tile is available with the Arrhythmia option only.



Arrhythmia Split Screen Waveform Tile displays a 2.5 to 8 second waveform. The lower half displays the last abnormal event detected and event time stamp. The Abnormal Beats per Minute count (ABN/MIN) replaces the waveform label. This tile is available with the Arrhythmia option only.



Overview Tile displays monitor, patient ID, and alarm status for up to 8 patients.

Figure2-7. Parameter, Waveform, and Overview Tiles

2.3.2 Menu Keys

Control of the touchscreen is accomplished through the menu keys located at the bottom of the screen.

Make a choice by touching a menu key. The system confirms the choice by highlighting the key and "clicking". The key function activates after removal of the finger.

Menu keys change as selections are made. The main menu keys are shown in Figure 2-8.

24 HOUR WAVEFORM (FULL DISCLOSURE) and ARRHYTHMIA are op-

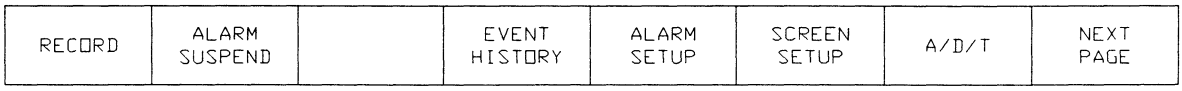


Figure 2-8. Main Menu Keys

tional; therefore, the Main Menu Keys may vary slightly. Figure 2-9 illustrates the addition of these options along with the standard main menu keys.

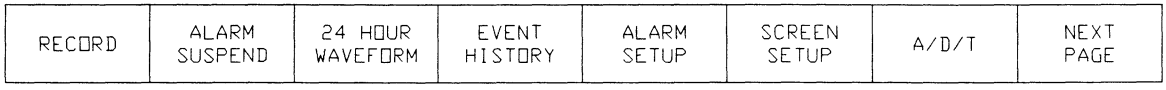


Figure 2-9. Optional Main Menu Keys

Additional menu keys are found by touching NEXT PAGE, as illustrated in Figure 2-10.

SELECT PATIENT	SYSTEM SETUP	PATIENT ARCHIVE		EXIT

Figure 2-10. Additional Menu Keys

All functions of the **ESCORT-LINK** Central Station are performed through the use of these menu keys. Their functions are described in *Section 3, "Standard Operational Procedures,"* and *Section 4, "Optional Operational Procedures."*

3. STANDARD OPERATIONAL PROCEDURES

The **ESCORT-LINK** Central Station can be configured to monitor from one to thirty-two patients and to record information at the Central Station. There are several standard features included in the **ESCORT-LINK**:

- Monitor and Patient identification, allowing continuity of a patient's vital signs history throughout the monitoring period.
- Flexible alarm settings, minimizing nuisance alarm tones and wasted paper.
- Event History, providing paperless storage of 20 second waveform segments of each alarming event with annotation.
- Trend, automatically storing 24 hours of parameter data in graph format.
- Single channel thermal array recorder.

3.1 ADMIT / DISCHARGE / TRANSFER

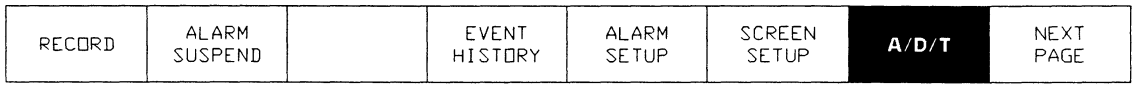
Introduction

The **ESCORT-LINK** Central Station automatically labels information for each monitored patient with the bedside monitor identification. In addition, you can include the patient's name, ID number, and/or location. By using the A/D/T key, patient identification can be entered, deleted, edited, or transferred from one monitor to another.

When a patient is discharged, the patient data should be cleared to prevent merging of the discharged patient's data with the next patient.

Using the Menu Keys

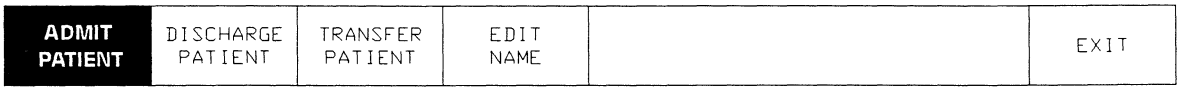
Touch A / D / T to display the Admit, Discharge, Transfer, and Edit keys.



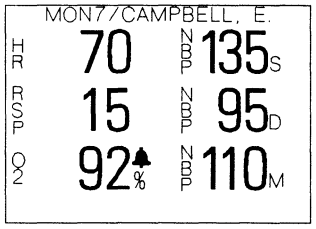
ADMIT PATIENT

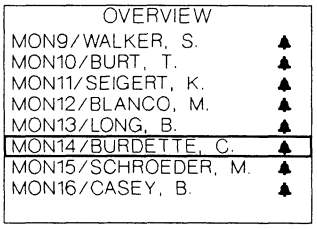
Patient identification should be entered when a new patient is connected to the bedside monitor.

Touch ADMIT PATIENT.



Touch the parameter tile or Overview line associated with the monitor assigned to the new patient.





Enter the patient's identification through the keyboard in Figure 3-1.

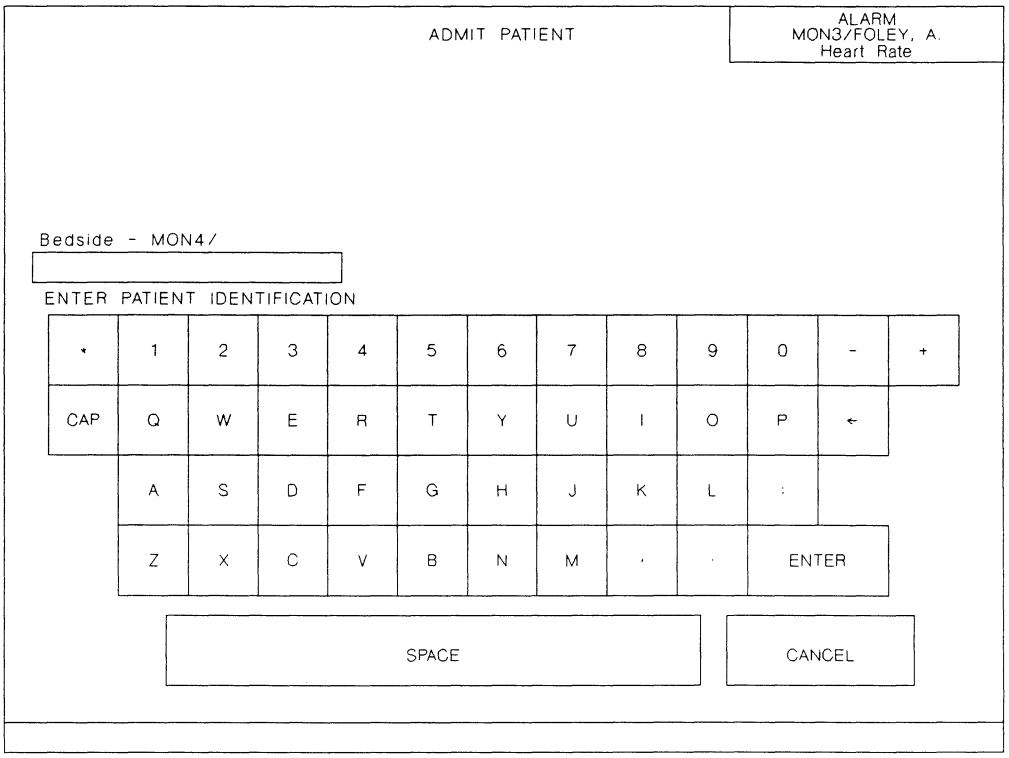


Figure 3-1 Patient Identification Admission Screen

NOTE: When the main screen is replaced by another (such as the Admission Screen), an active alarm will appear in a red alarm box in the upper right hand corner of the screen with the monitor identification, patient name, and type of alarm.

Touch ENTER to save the information and return to monitoring screen.

You must respond to the question "Do you wish to clear ALL existing bedside information?".

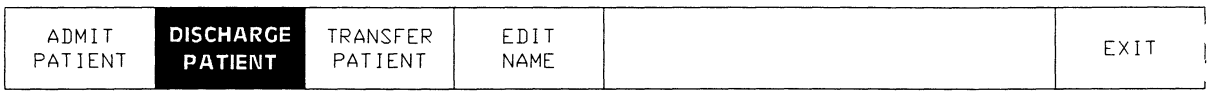
- Touch NO if data collected prior to entering patient identification is to be retained in the data file.
- Touch YES if data collected prior to entering patient identification is to be deleted from the data file.

DISCHARGE PATIENT

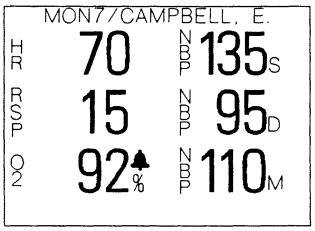
Patient identification should be deleted when the patient is discharged.

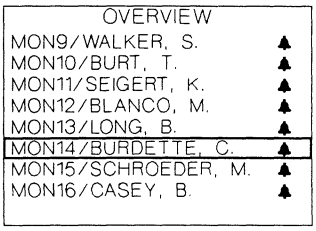
Touch DISCHARGE PATIENT.

Touch the parameter tile or Overview line of the patient to be discharged.



You must respond to the message, "Discharging this patient will clear ALL information!"





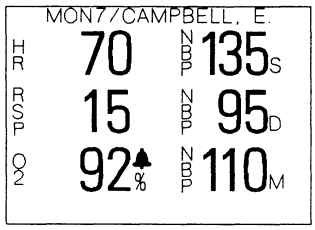
- Touch YES to proceed.

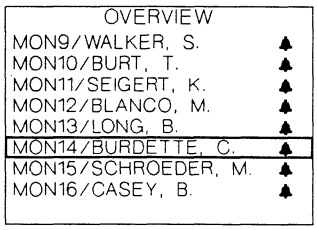
CAUTION: All previously collected information will be erased.

TRANSFER PATIENT

Touch TRANSFER PATIENT to transfer a patient and associated data from one monitor to another.

Touch the parameter tile or Overview line of the patient to be transferred.





Touch the destination tile to designate the new monitor for the patient. All patient data, including Event History, Trend Data, and 24-Hour Waveform (if available), will transfer to the new monitor.

EDIT NAME

Touch EDIT NAME to make additions and/or corrections to a patient's identification.

Touch the parameter tile or Overview line of the patient identification to be edited.

Type the corrected information, and touch ENTER to complete the change.

CAUTION: EDIT NAME should only be used to correct errors or add information. DO NOT use EDIT NAME to admit a new patient.

3.2 ALARM SETUP

Introduction

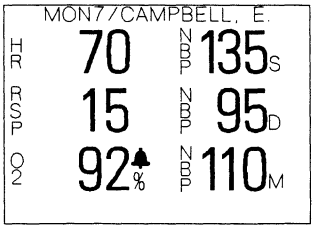
Visual and audio alarm indication is provided for all monitored patients. You can minimize nuisance alarms by individually customizing alarm criteria for each patient. Each event can be programmed to produce any combination of an audible tone, event history storage, or automatic recording. Alarms are assigned a priority level. Alarms can be temporarily suspended or disabled for any patient monitored.

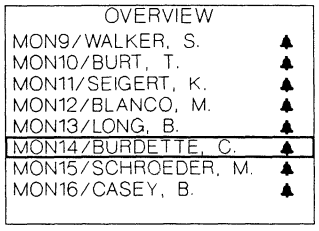
NOTE: The Alarm Setup can be programmed to initialize with the settings and alarm limits appropriate for your patient population. This setup is performed through the Configuration System menu key (see Section 6.1). Use the Alarm Setup page only when patient-specific adjustments to the limits and alarm settings are needed.

Using the Menu Keys

Touch ALARM SETUP.

Touch the parameter tile or Overview line of the patient whose alarms are to be adjusted.





The screen shown in Figure 3-2 establishes the alarm protocol for the selected patient.

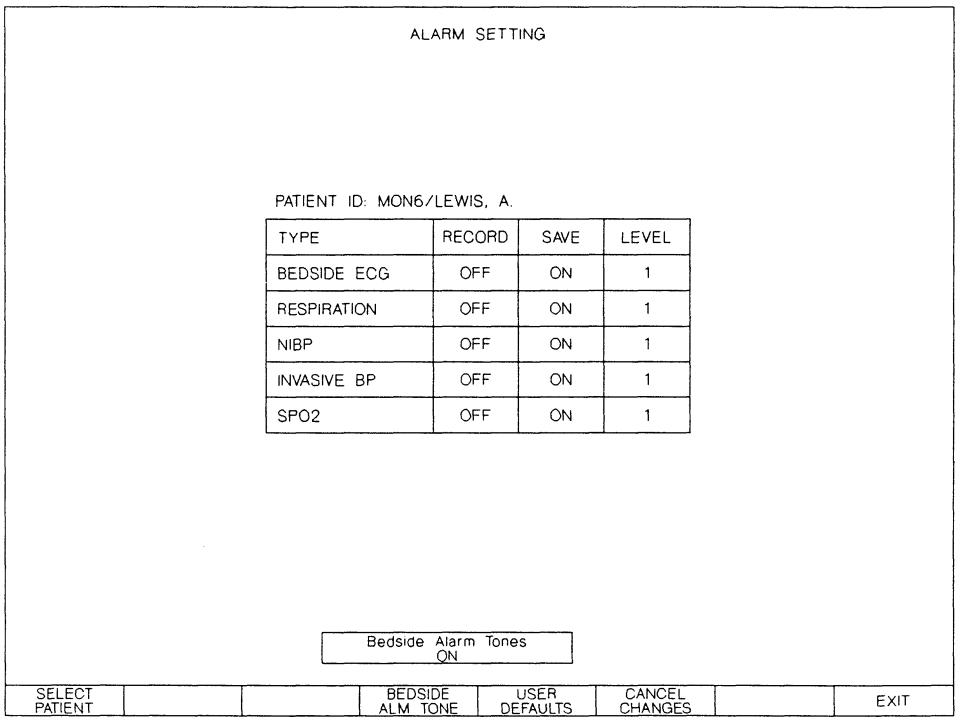


Figure 3-2. Alarm Setup Screen (without Arrythmia)

RECORD: When ON, records the displayed waveform each time the event is detected. Recordings are at least 20 seconds or for the duration of the event.

SAVE: When ON, stores 20 seconds of waveform in Event History each time the event is detected.

LEVEL: 1, 2, or 3 defines the seriousness and priority of the alarm event. Level 1 alarm events have priority over Level 2 and 3 events. Level 2 alarm events have priority over Level 3 events. Higher level events will override concurrent lower level alarm messages and tones.

Level of Alarm	Audible Tone	Visual Message
1 - Most Serious (Life Threatening)	Modulated - High/Low Once per second	Flashing Red - Once per second
2 - Serious	Once per second	Flashing Yellow - Once per second
3 - Informational	Once every 4 seconds	Continuous Yellow

Table 3-1. Alarm Levels

Visual alarm status is provided for all monitored patients. For patients having parameter tiles, a separate visual alarm indicator displays for each parameter with an enabled alarm. For a patient in *Overview*, one indicator applies to all parameters. Visual alarm indicators are defined in Table 3-2.

Visual Indicator	Parameter Tile	Overview Patient
Blank	Parameter Alarm OFF/disabled at bedside and central station.	All alarms OFF/disabled at bedside and central station.
White Bell	Parameter alarm ON/enabled at bedside or Central Station	At least one parameter alarm ON/enabled at bedside or central station.
Flashing Red Bell (Level 1)	Level 1 alarm violation for parameter.	Level 1 alarm violation for at least one parameter.
Flashing Yellow Bell (Level 2 or 3)	Level 2 or 3 alarm violation for parameter.	Level 2 or 3 alarm violation,with alarms suspended.
Flashing Red or Yellow Bell Crossed Out	Alarm violation for parameter, with alarm suspended.	At least one parameter alarm violation, with alarms suspended.
White Bell Crossed Out	Parameter alarm ON/enabled at bedside, with alarms suspended.	At least one parameter alarm is ON/enabled at bedside, with alarms suspended.
OFF		Bedside monitor is turned OFF, or is not communicating with the Central Station.
DIS		ECG is disconnected (check leads).

Table 3-2. Visual Alarm Indicators

BEDSIDE ALARM TONES

Touch BEDSIDE ALM TONE to disable/enable the audible alarm tone at the bedside monitor.

SELECT PATIENT	RELEARN	STANDBY	**BEDSIDE ALM TONE**	USER DEFAULTS	CANCEL CHANGES	ARR ON/OFF	EXIT

Confirm by touching "YES" in response to the statement, "WARNING: You are about to disable bedside alarm tones! Are you sure?".

NOTE: Only the audible alarm tone at the bedside monitor is affected, not the audible alarm tone at the Central Station. Control of bedside audible alarms automatically reverts to the bedside monitor if bedside to Central Station communication stops for any reason.

USER DEFAULTS

Touch USER DEFAULTS to set alarm parameters for this patient to the default settings.

SELECT PATIENT	RELEARN	STANDBY	BEDSIDE ALM TONE	**USER DEFAULTS**	CANCEL CHANGES	ARR ON/OFF	EXIT

When a patient is admitted or discharged, default settings automatically return.

CANCEL CHANGES

Touch CANCEL CHANGES to restore previous settings.

SELECT PATIENT	RELEARN	STANDBY	BEDSIDE ALM TONE	USER DEFAULTS	**CANCEL CHANGES**	ARR ON/OFF	EXIT

SELECT PATIENT

Touch SELECT PATIENT to modify or review alarm settings for other patients, or touch EXIT to return to the main menu.

SELECT PATIENT	RELEARN	STANDBY	BEDSIDE ALM TONE	USER DEFAULTS	CANCEL CHANGES	ARR ON/OFF	EXIT

ALARM SUSPEND

Audible alarms and recordings can be temporarily suspended from the Central Station for 180 seconds. At the end of the suspend period, they are automatically re-enabled.

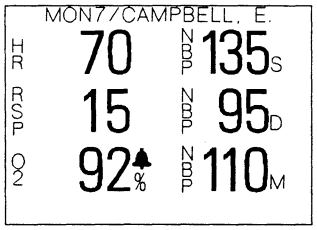
Alarms are automatically suspended when the Central Station is powered up, when a patient is transferred from one monitor to another, and at the end of the Standby period when Arrhythmia is activated (available only through the Arrhythmia option).

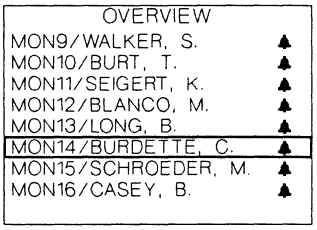
When alarms are suspended for a patient, the parameter tile displays an "ALARM SUSPEND - XXX" message at the bottom of the tile (XXX shows the time in seconds remaining in the suspended period). Alarm suspend for a patient in *Overview* is depicted by a crossed-out bell.

Touch ALARM SUSPEND. All Central Station audible tones will reset for 10 seconds.

RECORD	ALARM SUSPEND	24 HOUR WAVEFORM	EVENT HISTORY	ARR/ALARM SETUP	SCREEN SETUP	A/D/T	NEXT PAGE

Touch the parameter tile or Overview line of the patient whose alarms and recordings are to be temporarily suspended for 180 seconds.





3.3 RECORD

Introduction

The recorder provides vital sign and waveform documentation. When alarm recordings are enabled, each alarm initiates a recording as defined by the recording format in Table 3-3. Manual recordings are always enabled.

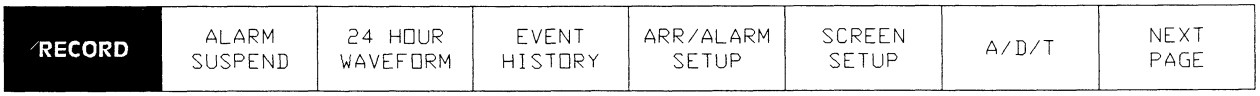
All recordings include vital sign tabular data. If the patient's waveform is displayed at the Central Station, then the tab is followed by at least a 20 second waveform strip. All waveform recordings have a 16 second delay, or memory. In the event of multiple overlapping alarm and manual requests, waveform and parameter data is automatically stored and recorded in the order of occurrence. Up to 32 manual and alarm record requests can be queued.

Tile Type	Recording Format
Parameter and Waveform	Vital sign tab followed by displayed waveform.
Parameter	Vital sign tab.
Overview	Vital sign tab.

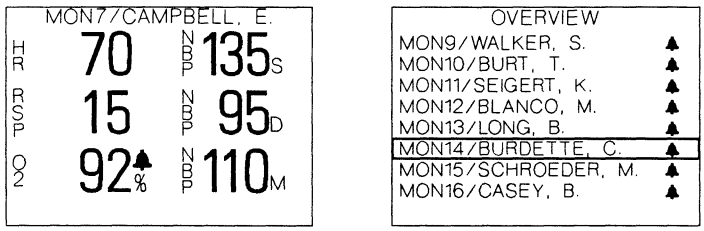
Table 3-3. Recording Formats

Using the Menu Keys

Touch RECORD.



Touch the parameter tile or Overview line of the patient to be recorded.



NOTE: To initiate a continuous recording, touch and hold the tile for two seconds. The message "CONTIN RECORD" is displayed in the menu.

Touch CANCEL RECORDING to stop a recording in progress.

SELECT A BEDSIDE TO RECORD	ABORT ALL RECORDING	**CANCEL RECORDING**	SAVE TO MEMORY	ALARM SUSPEND	EXIT

Touch SAVE TO MEMORY to store a 20 second waveform snapshot in Event History.

SELECT A BEDSIDE TO RECORD	ABORT ALL RECORDING	CANCEL RECORDING	**SAVE TO MEMORY**	ALARM SUSPEND	EXIT

Touch the parameter tile of the patient waveform to be stored in Event History.

Recordings can be initiated from the bedside monitor. If no recorder is available in the bedside monitor or if the bedside monitor's recorder is out of paper, the Central Station will generate the recording.

Touch ABORT ALL RECORDING to cancel all recordings that are queued.

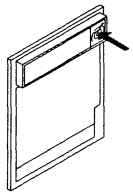
SELECT A BEDSIDE TO RECORD	**ABORT ALL RECORDING**	CANCEL RECORDING	SAVE TO MEMORY	ALARM SUSPEND	EXIT

Touch either bedside RECORD key to initiate a manual recording at the Central Station from the bedside monitor.

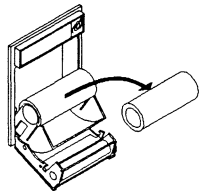
The message "LINK RECORD SENT" appears at the bedside monitor.

NOTE: To initiate a continuous recording, touch and hold either RECORD 1 or RECORD 2 key for two seconds. The message "LINK CONT RECORD SENT" appears at the bedside monitor.

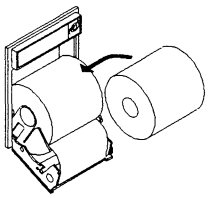
INSTALLING RECORDER PAPER



Press the recorder door release switch.

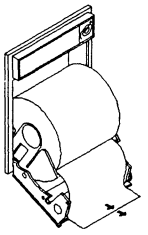


Remove the core of the spent roll.

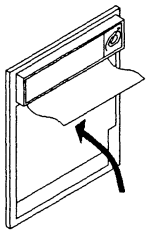


Exchange the paper roll (MDE Model E2700-32 or equivalent).

CAUTION: If paper is inserted backwards, the heat sensitive side of the paper is not exposed to the thermal array print head, and information does not record.

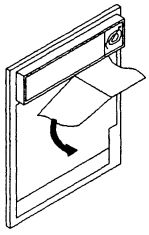


Pull out about 3 inches of paper and position paper between the two paper guides.



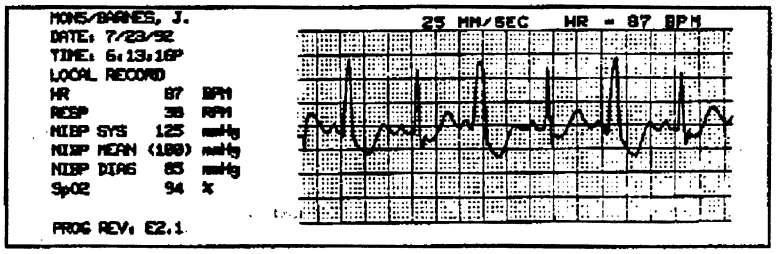
Close the door, making sure that the paper remains between the paper guides.

Initiate a recording to confirm proper operation. Sample recordings are shown and detailed in Figures 3-3 and 3-4.

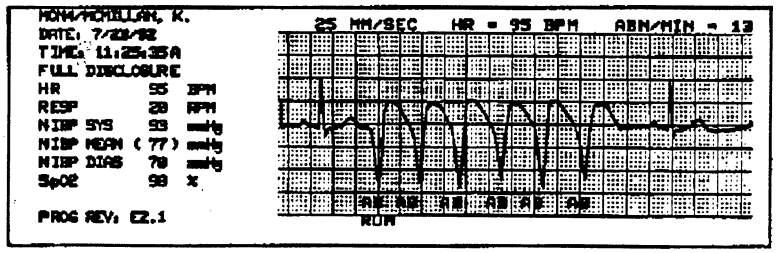


NOTE: Always tear the paper using a downward motion.

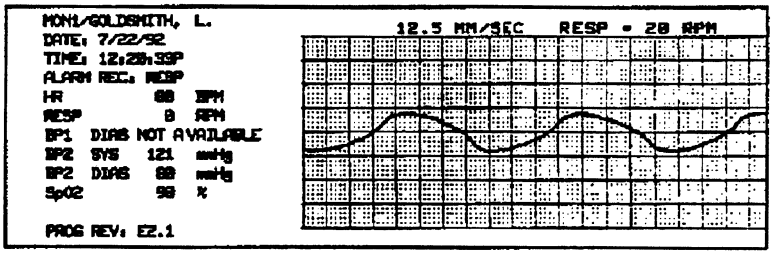
ECG



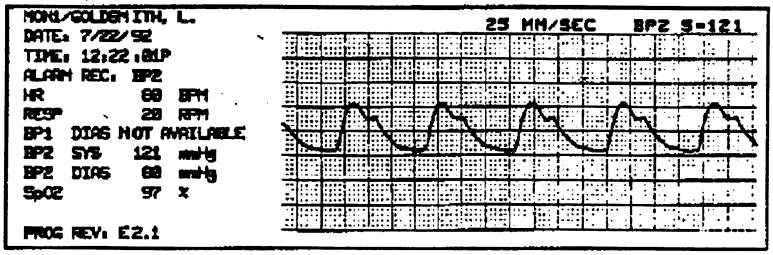
ARRHYTHMIA
WITH ANNOTATION



RESPIRATION



IBP



PLETH

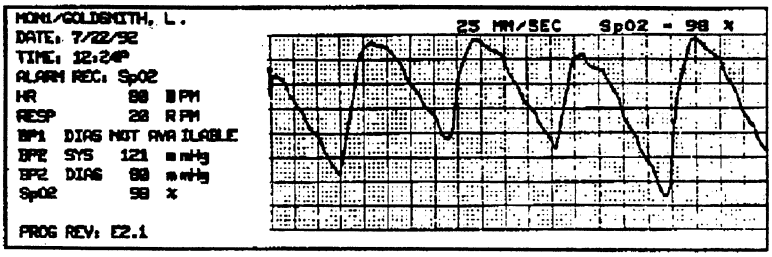
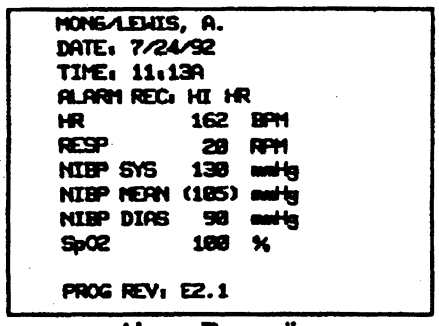
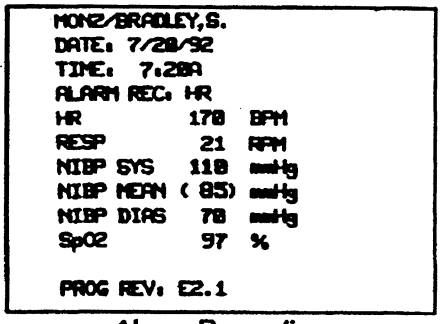


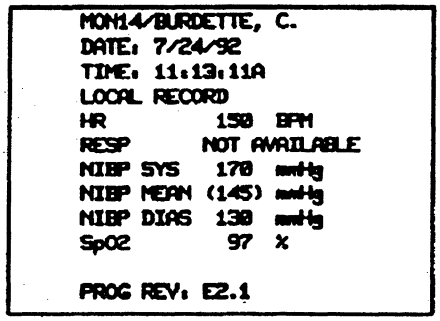
Figure 3-3. Sample Waveform Recordings



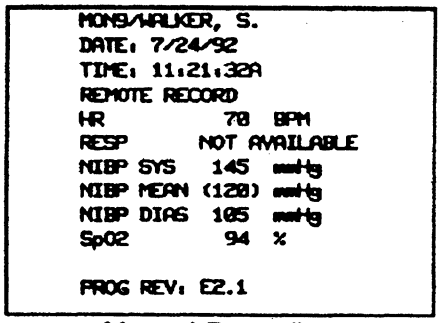
Alarm Recording



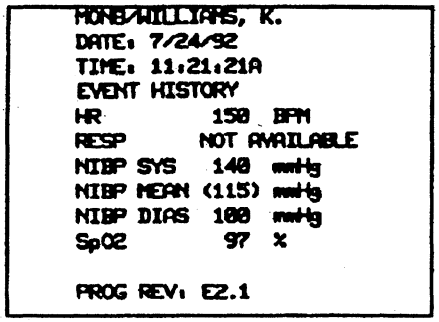
Alarm Recording
(Initiated during Multiple Alarms)



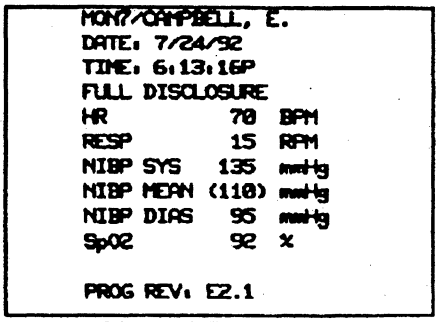
Manual Recording
(Initiated from Central Station)



Manual Recording
(Initiated from Bedside Monitor)



Manual Recording
(Initiated from Event History)



Manual Recording
(Initiated from Full Disclosure)

Figure 3-4. Sample Tabular Recordings

3.4 EVENT HISTORY

Introduction

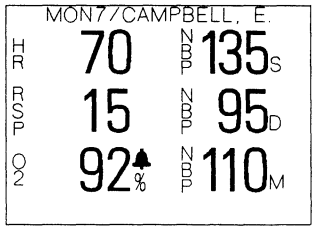
Event History provides paperless storage of 20-second strips of each abnormal event with annotation. Up to 100 abnormal events per patient are stored. Events can be reviewed, cleared, or documented on the thermal array recorder. A waveform must be displayed before it can be stored in Event History.

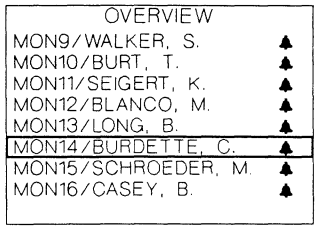
Using the Menu Keys

Touch EVENT HISTORY.

RECORD	ALARM SUSPEND	24 HOUR WAVEFORM	**EVENT HISTORY**	ARR/ALARM SETUP	SCREEN SETUP	A/D/T	NEXT PAGE

Touch the parameter tile or Overview line of the patient to be reviewed.





The Event History screen, shown in Figure 3-5, lists the 11 most recent events. Each event is listed by date and time of occurrence and class. The highlighted event in the middle of the list is displayed on the screen as a 20-second waveform segment.

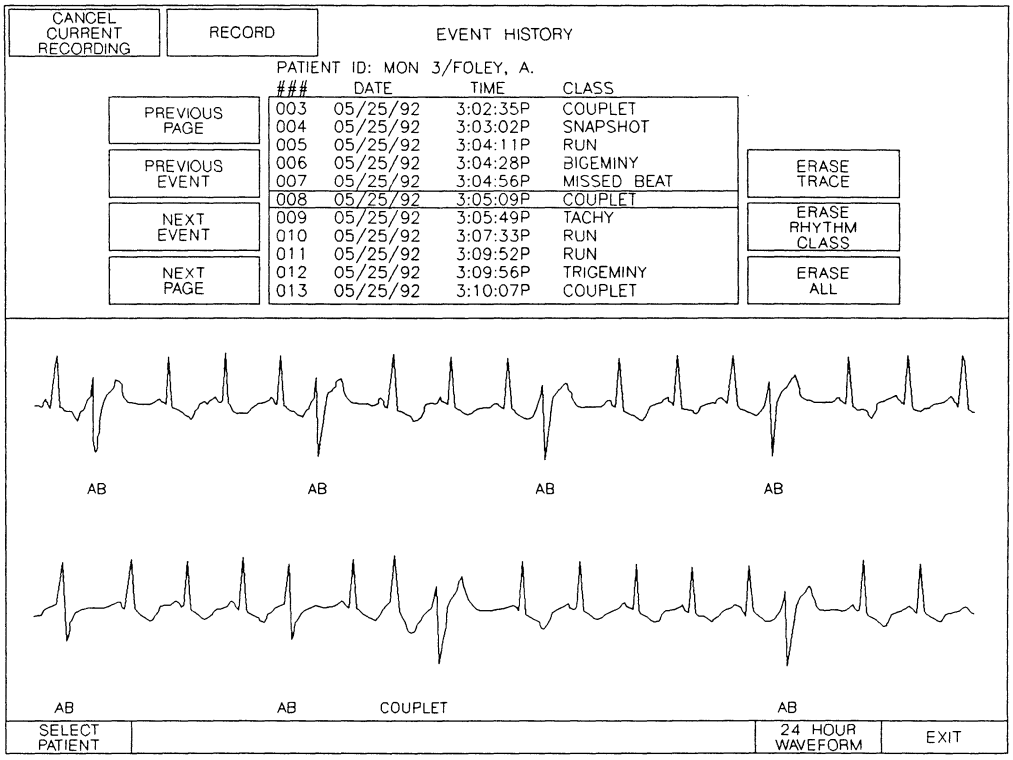


Figure 3-5. Event History Screen

RECORD

Touch RECORD to obtain a 20-second waveform strip of the event with annotation.

Touch CANCEL RECORDING to terminate the recording in progress.

SELECT A NEW EVENT

Touch PREVIOUS PAGE or NEXT PAGE and PREVIOUS EVENT or NEXT EVENT to highlight a new event.

ERASE EVENT

Touch ERASE TRACE to delete the highlighted event from Event History.

Touch ERASE RHYTHM CLASS to delete all events of the type currently highlighted.

Touch ERASE ALL to clear all events for that patient from Event History.

SELECT PATIENT

Touch SELECT PATIENT to select other patients being monitored on this Central Station, or touch EXIT to return to the main menu.

24 HOUR WAVEFORM

Touch 24 HOUR WAVEFORM to select this patient's Full Disclosure 24 Hour Waveform marked at the time of the event last displayed.(**NOTE: Full Disclosure is an option and may not be available on your system.**)

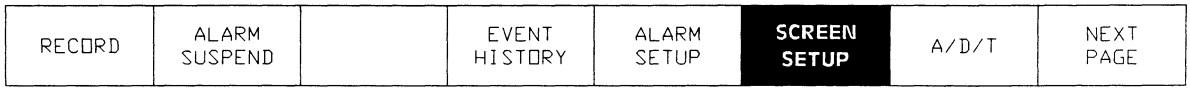
3.5 SCREEN SETUP

Introduction

Change, remove, or add waveforms, move tiles, and change screen colors to set up the screen.

Using the Menu Keys

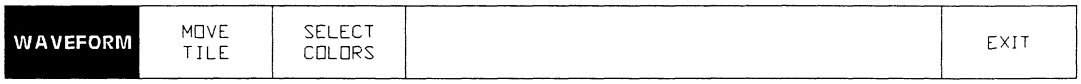
Touch SCREEN SETUP.



3.5.1 Waveform

Up to eight waveforms can be displayed at one time on the main screen. Although only one waveform is displayed per patient, waveforms can be removed or changed at any time.

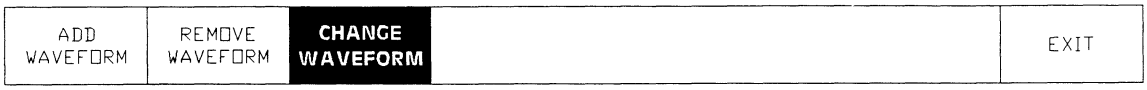
Touch WAVEFORM.



Touch ADD WAVEFORM to add a waveform tile to the right of a parameter tile. Touch a vacant "NOT ASSIGNED" waveform tile to convert it to a waveform tile.

Touch REMOVE WAVEFORM to remove a waveform from a tile. Touch the waveform tile to be removed.

Touch CHANGE WAVEFORM to change a waveform display. Choices can include ECG, Respiration, SpO_2 pleth, and Invasive blood pressure. Touch and release the waveform tile to change. Waveform labels change as you scroll through them.



NOTE: If the Arrhythmia option is included, the ECG waveform must be displayed in order to perform Arrhythmia analysis on a patient's ECG.

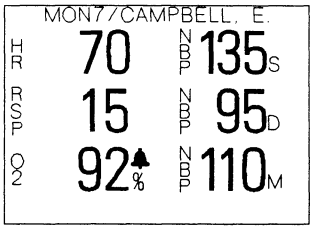
When Arrhythmia monitoring is enabled for a patient, the waveform label is replaced by the Abnormal Beats per Minute count (ABN/MIN=0). Changing or removing the ECG waveform is not possible during arrhythmia monitoring.

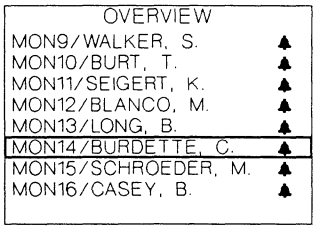
3.5.2 Move Tiles

Monitors are assigned initial tile locations and monitoring levels, but these locations and monitoring levels can be changed at any time. For example, a patient in *Overview* can be moved into a parameter or parameter/waveform tile to increase the level of monitoring of that patient.

Touch MOVE TILE.

Touch the parameter tile or *Overview* line of the patient to be moved.





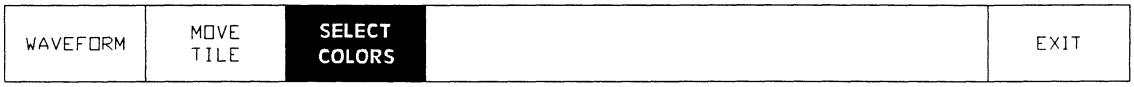
Touch the tile or *Overview* line of the destination. If the format permits, a waveform automatically appears.

NOTE: An arrhythmia channel cannot be moved to a tile location that does not permit a waveform tile.

3.5.3 Select Colors

SELECT COLORS allows you to choose one of four predefined color schemes for the touchscreen. Alarm indicator colors remain the same regardless of the color scheme chosen.

Touch SELECT COLORS until the touchscreen displays the desired color scheme.



3.6 TREND DATA

Introduction

All parameters for all patients monitored by the **ESCORT-LINK** Central Station are trended for 24 hours. Trend data automatically accumulates for as long as bedside communication is established.

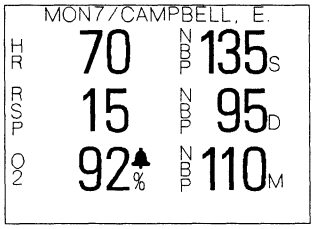
All patient alarms continue to be monitored while viewing trend data. If an alarm violation occurs, an alarm message displays on the Trend Plot screen indicating the monitor/patient ID and parameter in violation. Multiple alarm violations display one at a time in rotation.

Patient trend data can be saved through the Archive Data option to diskette or printed directly to a Hewlett-Packard LaserJet IIIP.

Using the Menu Keys

Touch TREND DATA.

Touch the parameter tile or *Overview* line to display the Trend for that patient.



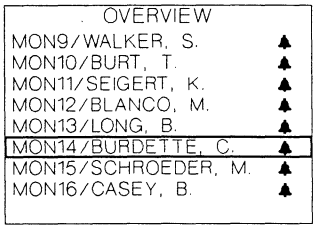


Figure 3-6 shows a Trend Plot screen.

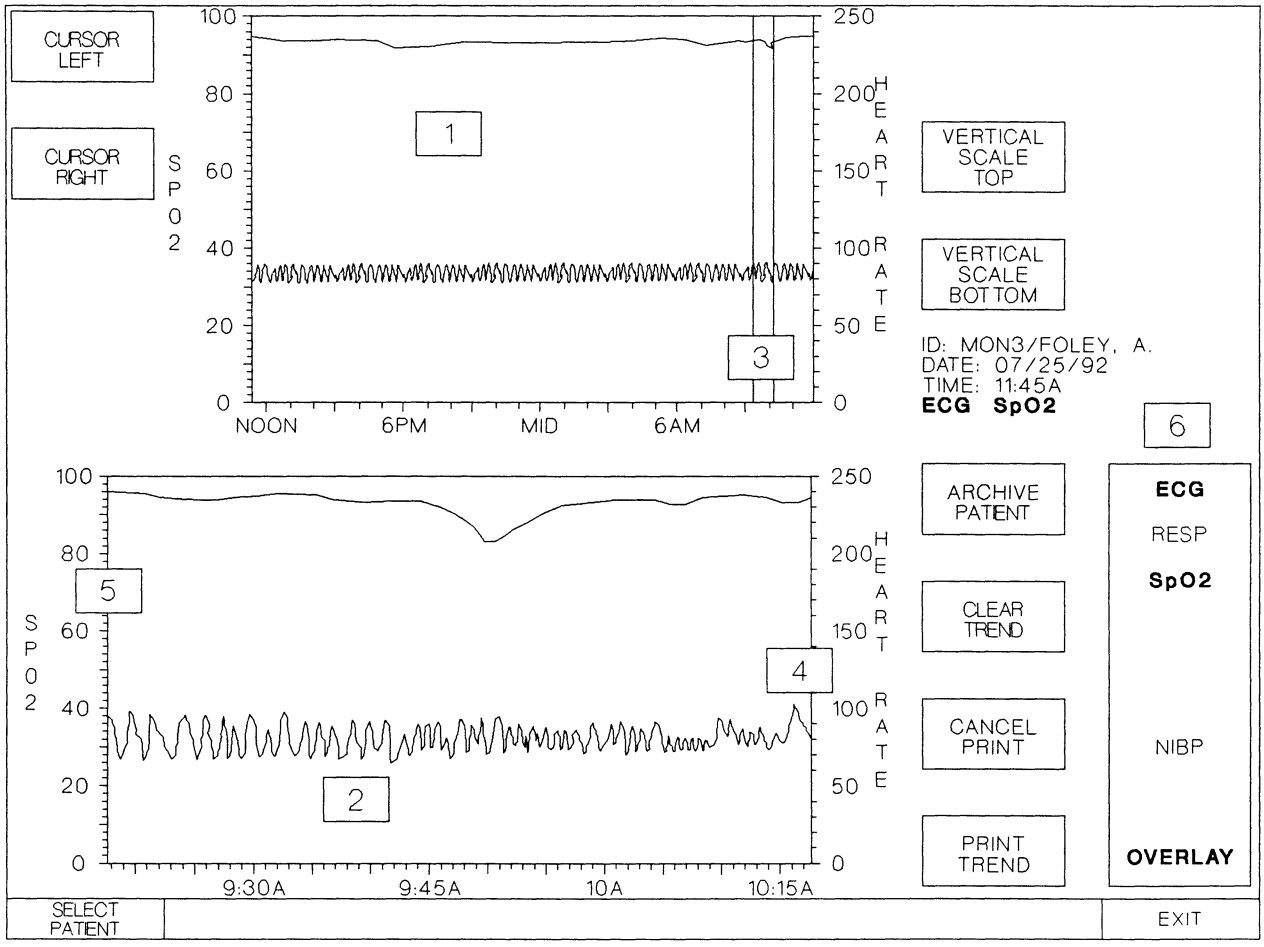


Figure 3-6. Trend Plot Screen

1 24 Hour Plot
2 1 Hour Plot
3 Cursor Bar
4 Scale for first parameter selected
5 Scale for second parameter selected
6 Parameter List

NOTE: The ARCHIVE PATIENT key is displayed if the Archive option is included.

CURSOR BAR

The cursor bar, in the upper plot, defines the 1-hour interval to be used as the timebase in the 1-hour plot.

Touch CURSOR LEFT or CURSOR RIGHT to move the cursor bar to zoom in on any 1-hour segment displayed on the bottom of the screen.

PARAMETERS

Available parameters to display are listed in the lower right portion of the screen. Parameters can be displayed individually or in combination.

Touch the desired parameter name to display it in the Trend plot.

Touch OVERLAY to display two parameters at the same time. Then touch the second parameter to be displayed.

VERTICAL SCALES

Touch VERTICAL SCALE TOP and VERTICAL SCALE BOTTOM to adjust the top and bottom scales, respectively.

SELECT PATIENT

Touch SELECT PATIENT to display a list of patients from which to choose.

The trend parameters and cursor bar location remain the same as you select different patients.

PRINT

If a Hewlett-Packard LaserJet IIIP is connected, Trend plots may be printed.

Touch PRINT to generate a copy of the Trend Plot screen.

Touch CANCEL PRINT to terminate printing.

CLEAR TREND DATA

Trend data is automatically cleared through the use of the patient discharge key. The CLEAR TREND key is an alternate method which may be used to clear trend data.

Touch CLEAR TREND to remove all trended information for a patient. You must confirm your choice by touching YES in response to the question, "PLEASE CONFIRM: Clear ALL trend information on this patient?" before proceeding.

3.7 Automated Vital Signs Charting

Introduction

Automated Vital Signs Charting is a tabular trend function. This function allows you to display and print out vital sign information in numeric tabular trend form for any patient being monitored at the **ESCORT-LINK** Central Station. The tabular trend function stores as many vital signs as are being displayed in a parameter tile (maximum of six) for up to 24 hours.

Accessing the Tabular Trend Screen

Follow the steps below to access the tabular trend screen on your **ESCORT-LINK** Central Station:

1. Make sure the **ESCORT-LINK** software, version 2.3.4 or later has been installed on your system.

2. Allow patient data to accumulate in a parameter tile at the Central Station for at least several minutes.

3. Press the *NEXT PAGE* key at the bottom right of your screen. The keys displayed at the bottom of the screen change.

4. Press the *TREND DATA* key at the bottom left of your screen. The following message appears:

   Select a bedside for Trending

5. Press anywhere within the parameter tile of the bedside monitor from which you want trending information. The screen display changes to the tabular trend display (see Figure 3-7 on the next page).

You now have several options for displaying and printing the trend information. See the following sections for descriptions of the keys and how to use them to either display or print out the trend information.

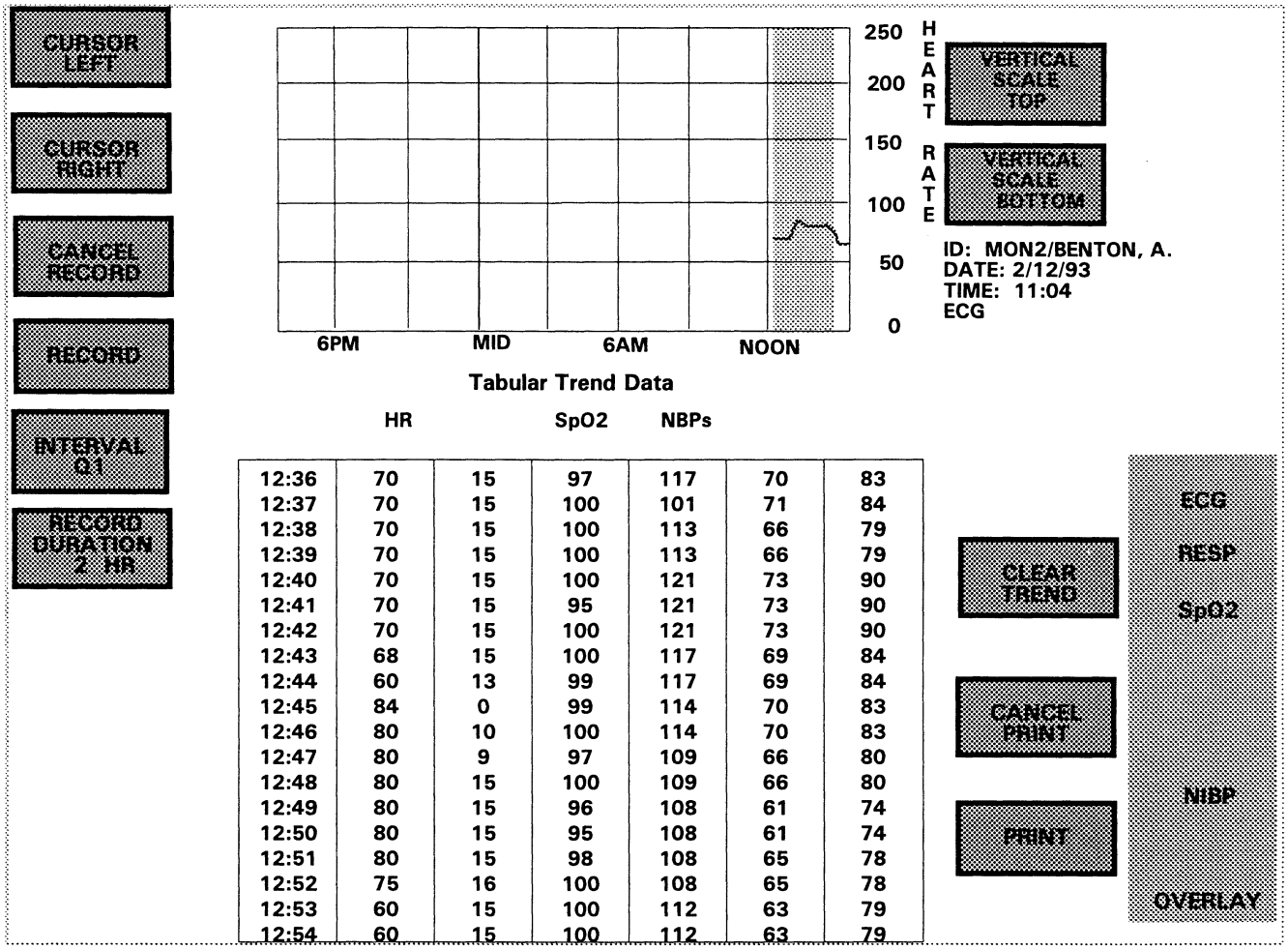


Figure 3-7. The Tabular Trend Display Screen

Tabular Trend Data and Graph Areas

There are two areas for displaying vital sign information on the tabular trend display screen: the Tabular Trend Data box at the bottom of the screen, and the graph at the top of the screen.

The Tabular Trend Data box contains 19 entries of time, with up to six vital signs per entry. The white (highlighted) area of the upper graph is the time window representing the 19 tabular entries in the data box. You can change the data box entries by using the cursor keys to move the window back or ahead on the timeline, and by changing the Q time on the *INTERVAL* key to the desired charting interval.

NOTE: For a printout of a full 8-hour shift, set the Q time to 1 minute, move the window cursor to the exact minute at which you want vital sign recording to end, and then change Q to 15 and DURATION to 8.

The graph at the top of the tabular trend screen displays up to two vital sign parameters in graph form. The vital signs that appear on the graph are indicated in red on the vertical key in the bottom right of the display screen.

Using the Menu Keys

CURSOR RIGHT & CURSOR LEFT Keys

Press these keys to move the tabular time window back or forward along the timeline. You can also press and hold the cursor keys to auto-advance the time window.

CANCEL RECORD Key

Press the *CANCEL RECORD* key to stop the recording in progress.

RECORD Key

Press the *RECORD* key to record a strip from the **ESCORT-LINK** recorder. The strip contains a tabular record of vital signs for the number of hours and entries determined via the *RECORD DURATION* and *INTERVAL* keys. See Figure 3-8 for an example of a record strip with tabular trend data.

TIME	HR	RESP	SpO2	NBPs	NBPd	NBPm	TIME	HR	RESP	SpO2	NBPs	NBPd	NBPm
12:36P	70	15	97	117	70	83	12:47P	80	9	97	109	66	80
12:37P	70	15	100	101	71	84	12:48P	80	15	100	109	66	80
12:38P	70	15	100	113	66	79	12:49P	80	15	96	108	61	74
12:39P	70	15	100	113	66	79	12:50P	80	15	95	108	61	74
12:40P	70	15	100	121	73	90	12:51P	80	15	98	108	65	78
12:41P	70	15	95	121	73	90	12:52P	75	16	100	108	65	78
12:42P	70	15	100	121	73	90	12:53P	60	15	100	112	63	79
12:43P	70	15	100	117	69	84	12:54P	60	15	100	112	63	79
12:44P	68	13	99	117	69	84	12:55P	60	15	100	114	63	78
12:45P	60	0	99	114	70	83	12:56P	60	15	100	114	63	78
12:46P	84	10	100	114	70	83	12:57P	60	15	99	121	66	88

Figure 3-8. Record Strip with Trend Data

INTERVAL Key

Press the *INTERVAL* key to select the vital sign interval to be displayed. The available intervals are every 1, 2, 3, 4, 5, 10, 15, 30, 45, or 60 minutes. Vital Signs reported are the actual vital signs displayed on the ESCORT bedside monitor at the indicated time; there is no averaging over time intervals.

RECORD DURATION Key

Press the *RECORD DURATION* key to select the duration of trend data recording you want. The available time periods are: 1 HR, 2 HR, 4 HR, 8 HR, 12 HR, and 24 HR.

The last entry of the recording will coincide with the vital sign entry on the last line of the Tabular Trend Data box.

PRINT Key

If you have a Laserjet printer connected to the **ESCORT-LINK**, a *PRINT* key will be displayed in the lower right area of the screen. Press the *PRINT* key to print out vital sign entries on 8.5 x 11-inch page(s). The vital sign entry interval and the length of time printed are determined by the Q interval and RECORD DURATION selected. See the example of a Laserjet printout of trend data on the next page.

MON/BENTON, A. Automated Vital Signs Chart Date 2/12/93

TIME	HR	RESP	SpO2	NBPs	NBPd	NBPm
11:28A	70	15	99	111	66	83
11:29A	70	15		111	66	83
11:30A	70	15		111	66	83
11:31A	70	15		111	66	83
11:32A	80	12		111	66	83
11:33A	94	15	100	111	66	83
11:34A	70	11	99	129	70	91
11:35A	70	8	98	129	70	91
11:36A	60	15	96	109	70	83
11:37A	60	15	98	109	70	83
11:38A	60	15	99	112	70	84
11:39A	69	13	97	112	70	84
11:40A	80	7	98	114	71	86
11:41A	80	15	99	114	71	86
11:42A	80	19	99	110	68	79
11:43A	70	8	99	110	68	79
11:44A	70	15		111	70	78
11:45A	70	13	99	111	70	78
11:46A	66	13	100	111	70	78
11:47A	80	13	96	122	73	86
11:48A	80	15	100	101	50	66
11:49A	80	15	88	101	50	66
11:50A	80	15	94	101	50	66
11:51A	80	15	100	129	62	99
11:52A	80	15	99	129	62	99
11:53A	80	15	99	109	75	85
11:54A	70	15	99	109	75	85
11:55A	70	15	100	109	81	88
11:56A	68	15	99	109	81	88
11:57A	73	12	99	108	74	83
11:58A	63	15	100	108	74	83
11:59A	70	11	99	108	69	79
12:00P	70	6	94	108	69	79
12:01P	70	15	100	119	75	82
12:02P	70	15	98	119	75	82
12:03P	70	15	100	111	71	82
12:04P	80	22	88	111	71	82
12:05P	70	10	100	111	71	82
12:06P	70	15	100	114	70	83
12:07P	60	15	100	114	70	83
12:08P	60	15	100	105	63	73
12:09P	60	15	100	112	72	81
12:10P	60	15	100	112	72	81
12:11P	60	15	100	104	68	87
12:12P	60	15	100	104	68	
12:[illegible]	60	15	10[illegible]	[illegible]	68	
12[illegible]	64	9			6[illegible]	
1[illegible]	[illegible]0	11				

TIME	HR	RESP	SpO2	NBPs	NBPd	NBPm
12:40P	70	15	100	121	73	90
12:41P	70	15	95	121	73	90
12:42P	70	15	100	121	73	90
12:43P	70	15	100	117	69	84
12:44P	68	13	99	117	69	84
12:45P	60	10	100	114	70	83
12:46P	84	10	100	114	70	83
12:47P	80	9	97	109	66	80
12:48P	80	15	100	109	66	80
12:49P	80	15	96	108	61	74
12:50P	80	15	95	108	61	74
12:51P	80	15	98	108	65	78
12:52P	75	16	100	108	65	78
12:53P	60	15	100	112	63	79
12:54P	60	15	100	112	63	79
12:55P	60	15	100	114	63	78
12:56P	60	15	100	114	63	78
12:57P	60	15	99	121	66	88
12:58P	60	15	100	121	66	88
12:59P	60	15	100	121	66	88
1:00P	60	15	100	65	28	44
1:01P	60	15	100	65	28	44
1:02P	60	15	99	65	28	44
1:03P	60	12	100	120	71	89
1:04P	60	15	95	120	71	89
1:05P	60	9		118	71	80
1:06P	60	15	85	118	71	80
1:07P	60	15	100	129	71	91
1:08P	60	15	100	129	71	91
1:09P	60	15	100	118	71	86
1:10P	60	15	100	118	71	86
1:11P	60	15	100	114	67	79
1:12P	60	15	0	114	67	79
1:13P	80	14	99	108	73	85
1:14P	80	15	100	108	73	85
1:15P	71	13	100	109	74	83
1:16P	60	14	100	109	74	83
1:17P	80	17	100	109	74	83
1:18P	80	15	99	106	47	62
1:19P	80	15	100	106	47	62
1:20P	80	15	99	106	47	62
1:21P	80	15	100	106	47	62
1:22P	80	15	99	106	47	62
1:23P	70	15	93	106	47	62
1:24[illegible]		15	99	10[illegible]		62
1:2[illegible]		15	100			62
1[illegible]		15	100			
[illegible]		[illegible]5	1[illegible]			

Figure 3-9. Part of a Laser Printout with Trend Data

4. OPTIONAL OPERATIONAL PROCEDURES

The **ESCORT-LINK** Central Station is configured to monitor from one to thirty-two patients and to record information at the Central Station. Options to the **ESCORT-LINK** include

- Arrhythmia processing, which may be added in increments of one to eight channels;
- Full Disclosure, a 24 hour history of waveform information;
- Archival Storage and Retrieval, using floppy diskettes to store trend data;
- LaserJet Printing, to preserve and document patient trend plots and tabular trend data, full disclosure waveform, and full scale waveform.

4.1 ARRHYTHMIA

The following section applies if your **ESCORT-LINK** includes the option for Arrhythmia processing. The **ESCORT-LINK** Central Station Arrhythmia option is available in single channel increments providing up to eight arrhythmia channels, assignable to any monitor in the system.

Introduction

Arrhythmias, or abnormalities in the rate, rhythm, or morphology of the ECG can be detected, classified, recorded, and saved in memory for future evaluation. This automated arrhythmia detection can be enabled for any patient monitored whose ECG waveform is displayed at the Central Station. **ESCORT-LINK** learns the patient's dominant cardiac rhythm and uses it as the basis by which it compares all other beats or groups of beats. When abnormal events are detected, they are classified and can be stored or printed for review. Rate, rhythm, and morphology abnormalities such as asystole, vfib, abnormal runs, missed beats, couplets, high abnormal rates, tachycardia, bigeminy, trigeminy, runs of nonpremature abnormals, and high and low heart rates are detected.

You can minimize nuisance alarms by individually customizing alarm criteria for each patient. Each event can be programmed to produce any combination of an audible tone, split-screen display, event history storage, or automatic recording. As a result, less critical arrhythmia events can be stored in event history without requiring an audible tone or alarm recording.

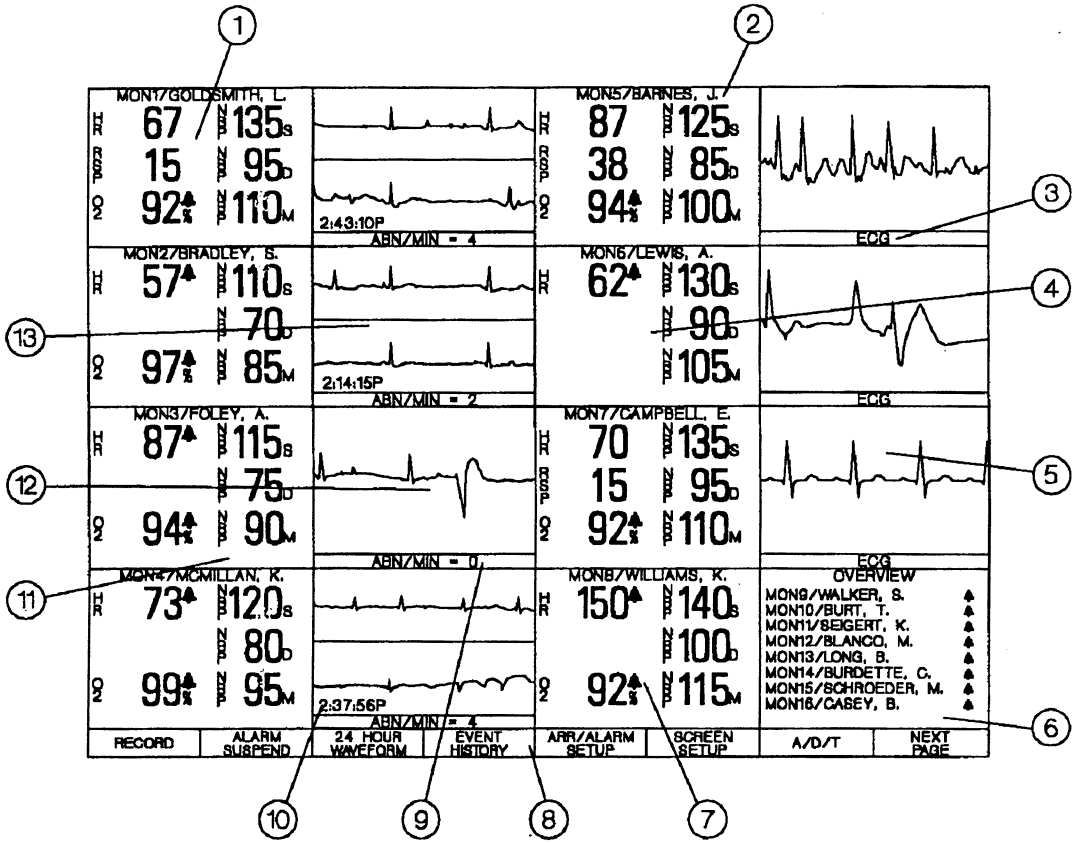


Figure 4-1. LINK with Arrythmia Main Monitoring Screen

1 Parameter Tile
2 Monitor/Patient ID
3 Waveform Label
4 Parameter Label
5 Waveform Tile
6 Overview Tile
7 Alarm Status
8 Menu Keys
9 ABN/MIN Count
10 Event Time Stamp
11 Message Field
12 Arrhythmia Waveform Tile
13 Split Screen Arrhythmia Waveform Tile

Beat Classifications

Each beat is compared to the patient's dominant cardiac beat, or template, which was determined during the LEARN period. If a match is detected, the beat is internally classified as Normal. If no match is detected, the beat is internally classified as Abnormal, Premature Abnormal, Paced, AVPaced, or Questionable. Table 4-1 describes the criteria for each of these classifications. If the beat matches but is premature, it is classified as Premature Normal.

Beat Type	Classification Criteria
Normal	A beat matching the most frequently occurring template during the last learning period.
Premature Normal	A beat matching the Normal and more than 20% premature compared to the average R-R of the last 16 beats.
Abnormal	A beat that does not match the Normal and is not classified as a Paced or AVPaced beat.
Premature Abnormal	An Abnormal which is more than 20% premature; used to classify Couplets and Runs.
Paced	Any beat within 200 milliseconds after a pacer artifact.
AVPaced	Any beat within 300 milliseconds after the first of 2 consecutive pacer artifacts.
Questionable	Any beat that does not match the Normal or a previously established template.

Table 4-1. Beat Classifications

Arrhythmia Event Classifications

After classifying each beat, the algorithm classifies groups of beats into one of twelve categories, or events. Arrhythmia events can be placed into the Event History and stored for future consideration. Each event can be assigned a level of priority, with 1 being the highest, followed by 2, and then 3. Asystole, Vfib, and Run are always treated as highest priorities and cannot be reassigned to Levels 2 or 3.

Event Type	The Event is Classified When:
Asystole	No beat is detected for 4 seconds.
Vfib	Triggered by a Vfib detection algorithm that recognizes chaotic patterns.
Run	The number of consecutive abnormal beats at a heart rate over 100 BPM equals or exceeds the RUN limit.
Missed Beat	An R-R interval which exceeds the average R-R interval by more than the missed beat factor times the average R-R interval.
Couplet	2 consecutive abnormals are detected.
High HR	The heart rate exceeds the limit set at either the bedside or central station.
Low HR	The heart rate falls below the limit set at either the bedside or central station.
High Ab Rate	The number of abnormal beats detected in the last minute equals or exceeds the Abnormal limit.
Tachy	The number of consecutive premature normals with R-R intervals less than 500 milliseconds exceeds the Tachy limit.
Bigeminy	The algorithm detects a sequence of Abnormal-Normal-Abnormal.
Trigeminy	The algorithm detects a sequence of Abnormal-Normal-Normal-Abnormal-Normal-Normal-Abnormal.
Slow Run	A RUN of consecutive abnormal beats at a heart rate of less than 100 BPM, exceeds the limit.

Table 4-2. Event Classifications and Definitions

Using the Menu Keys

ARRHYTHMIA AND ALARM SETUP

Touch ARR/ALARM SETUP. Touch a parameter tile or Overview line to select a patient.

RECORD	ALARM SUSPEND	24 HOUR WAVEFORM	EVENT HISTORY	**ARR/ALARM SETUP**	SCREEN SETUP	A/D/T	NEXT PAGE

The Arrhythmia/Alarm Setup screen shown in Figure 4-2 lists all event types, levels of priority, and limits, if appropriate, for each. In addition, you may toggle between ON and OFF to customize the record, save, hold waveform on screen, and audible alarm features. Parameter RECORD and SAVE can be toggled ON or OFF as well. ON keys are green, and OFF keys are red.

Arrhythmia monitoring can be enabled for any patient with a parameter and waveform tile combination. To enable arrhythmia monitoring for an Overview patient, move that Overview line into a parameter/waveform tile position.

Arrhythmia/Alarm Settings

PATIENT ID: MON6/LEWIS, A.

TYPE	RECORD	SAVE	HOLD	ALARM	LEVEL	LIMIT	↑	↓
ASYSTOLE	OFF	ON	ON	ON	1			
VFIB	OFF	ON	ON	ON	1			
RUN	OFF	ON	ON	ON	1	3	↑	↓
MISSED BEAT	OFF	ON	ON	ON	1	1.8	↑	↓
COUPLET	OFF	ON	ON	ON	2			
HI HR	OFF	OFF	OFF	OFF	2	150	↑	↓
LO HR	OFF	OFF	OFF	OFF	2	50	↑	↓
HI ABNORMAL	OFF	OFF	OFF	OFF	2	10	↑	↓
TACHY	OFF	OFF	OFF	OFF	2	8	↑	↓
BIGEMINY	OFF	OFF	OFF	OFF	2			
TRIGEMINY	OFF	OFF	OFF	OFF	2			
SLOW RUN	OFF	OFF	OFF	OFF	2	10	↑	↓
ECG	ON				1			
RESPIRATION	ON				1			
NIBP	ON				1			
INVASIVE BP	ON				1	Arrhythmia Processing ON		
SPO2	ON				1	Bedside Alarm Tones ON		

SELECT PATIENT	RE-LEARN	STANDBY	BEDSIDE ALM TONE	USER DEFAULTS	CANCEL CHANGES	ARR ON/OFF	EXIT

Figure 4-2. Arrythmia/Alarm Setup at Default Settings

RECORD: When ON, records the displayed waveform each time the event is detected. Recordings are at least 20 seconds or for the duration of the event.

SAVE: When ON, stores 20 seconds of waveform in Event History each time the event is detected.

HOLD: When ON, displays the most recent event of that type below the real time ECG trace in the waveform tile accompanied by the time of the event and the current abnormal beats per minute (ABN/MIN).

ALARM: When ON, enables the central audible alarm tone and visual alarm message.

LEVEL: 1, 2, or 3 defines the seriousness and priority of the alarm event. Level 1 alarm events have priority over Level 2 and 3 events. Level 2 alarm events have priority over Level 3 events. Higher level events will override concurrent lower level event alarm messages, tones, and held waveforms.

Level of Alarm	Audible Tone	Visual Message
1 - Most Serious (Life Threatening)	Modulated - High/Low Once per second	Flashing Red - Once per second
2 - Serious	Once per second	Flashing Yellow - Once per second
3 - Informational	Once every 4 seconds	Continuous Yellow

Table 4-3. Alarm Levels

LIMIT: Adjustments may be made for certain event types using the ↑ and ↓ keys. Increments for each event to which adjustments can be made are listed in Table 4-4.

EVENT	LIMIT RANGE MIN - MAX	INCREMENT
RUN	3 - 10	1
MISSED BEAT	1.5 - 3.0	0.1
HEART RATE (High)	50 - 250	5
HEART RATE (Low)	30 - 150	5
ABNORMAL RATE (High)	0 - 20 20 - 100	1 5
TACHY	1 - 10	1
SLOW RUN	3 - 10	1

Table 4-4. Event Limits

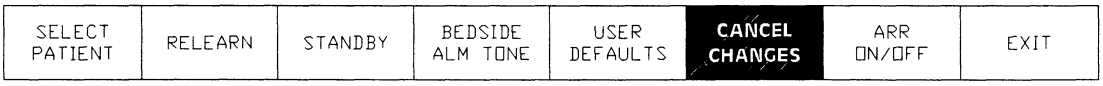
USER DEFAULTS

Touch USER DEFAULTS to quickly set all alarm parameters to the default positions.

NOTE: Establish user defaults through System Configuration.

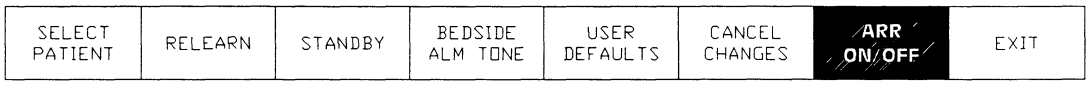
CANCEL CHANGES

Touch CANCEL CHANGES to cancel current changes and restore previous settings.



ARRHYTHMIA ON AND OFF

Touch ARR ON/OFF to toggle arrhythmia processing on and off.

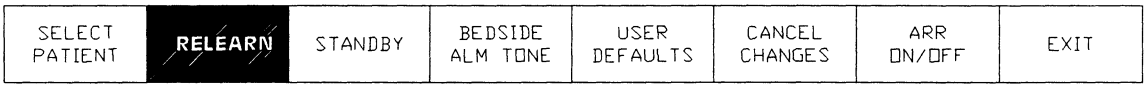


When ON is selected, the system learns the patient's dominant cardiac beat. If all arrhythmia channels are in use, the message, "ALL ARRHYTHMIA CHANNELS ARE ALREADY OCCUPIED," is displayed.

NOTE: If arrhythmia is ON and the key is touched, the message, "WARNING: ALL ARRHYTHMIA PROCESSING ON THIS PATIENT WILL BE DISCONTINUED! ARE YOU SURE?" is displayed. You must confirm your choice by touching YES. The message, "Check Bedside Alarms," appears in the message field, and a Level 3 tone sounds prompting you to confirm that appropriate bedside alarms are enabled.

RELEARN

Touch RELEARN, and the arrhythmia processor relearns the patient's dominant cardiac beat.



NOTE: Touch RELEARN whenever the patient's dominant beat changes significantly, particularly when a new ECG lead is monitored. If there is a loss of COMM or ECG disconnect condition for more than 1 minute, the system will automatically relearn when the signal is restored.

STANDBY

Touch STANDBY to suspend arrhythmia monitoring indefinitely. To resume arrhythmia monitoring, touch STANDBY again.

Standby may be necessary to suspend arrhythmia analysis when a suitable ECG signal is no longer available. A yellow "STANDBY" message will appear in the parameter tile and the message "ARR ALMS SUSPENDED" will appear below the waveform.

BEDSIDE ALARM TONE

Touch BEDSIDE ALM TONE to enable or disable the bedside monitor's audible alarm tone. You must confirm your choice by touching YES in response to the question, "Are you sure?".

NOTE: This key controls the audible alarm tone at the bedside monitor only—the audible alarm tone at the Central Station is unaffected. Control of bedside audible alarm tone automatically reverts to the bedside monitor if communication between the bedside and central is lost.

SELECT PATIENT

Touch SELECT PATIENT to change alarm settings for another patient.

4.2 FULL DISCLOSURE

The following section applies if your **ESCORT-LINK** includes the option for Full Disclosure/24 Hour Waveform.

Introduction

Full Disclosure, or 24 hour waveform, provides access to the last 24 hours of waveform for up to 8 patients. To store waveform information for a patient, the waveform must be displayed at the Central Station. Time, rate, and, if available, abnormal beats per minute are posted prior to each 30-second line of compressed waveform. If arrhythmia processing has identified events, the line is labeled with the most serious call. A red line is located below each event and extends the length of the event. Any portion of the 24 hour waveform is available for documentation through single channel recording or the optional LaserJet.

If a waveform other than ECG is being displayed in the waveform tile, that waveform and the value of that parameter will be stored.

Using the Menu Keys

24 HOUR WAVEFORM

Touch 24 HOUR WAVEFORM. Touch a parameter tile to select a patient.

RECORD	ALARM SUSPEND	**24 HOUR WAVEFORM**	EVENT HISTORY	ARR/ALARM SETUP	SCREEN SETUP	A/D/T	NEXT PAGE

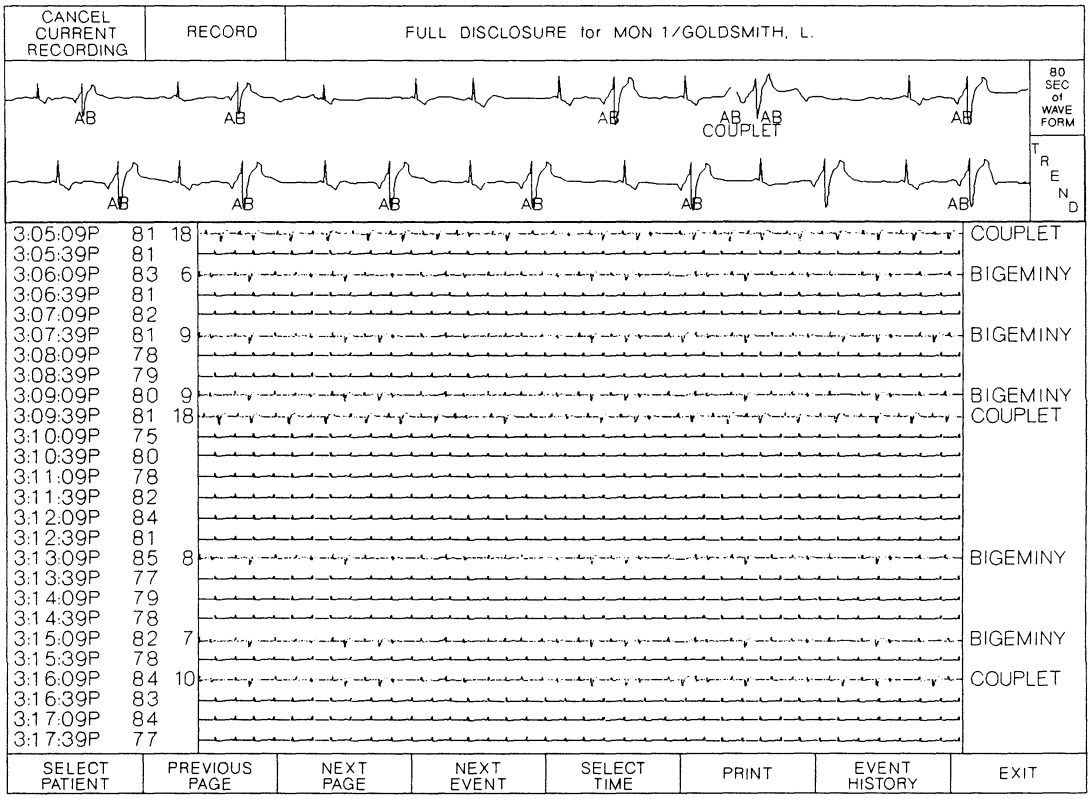


Figure 4-3. Full Disclosure/24 Hour Waveform

Each page displays 13 minutes of compressed waveform. A yellow bar covering a portion of the compressed waveform corresponds to the expanded waveform at the top of the screen.

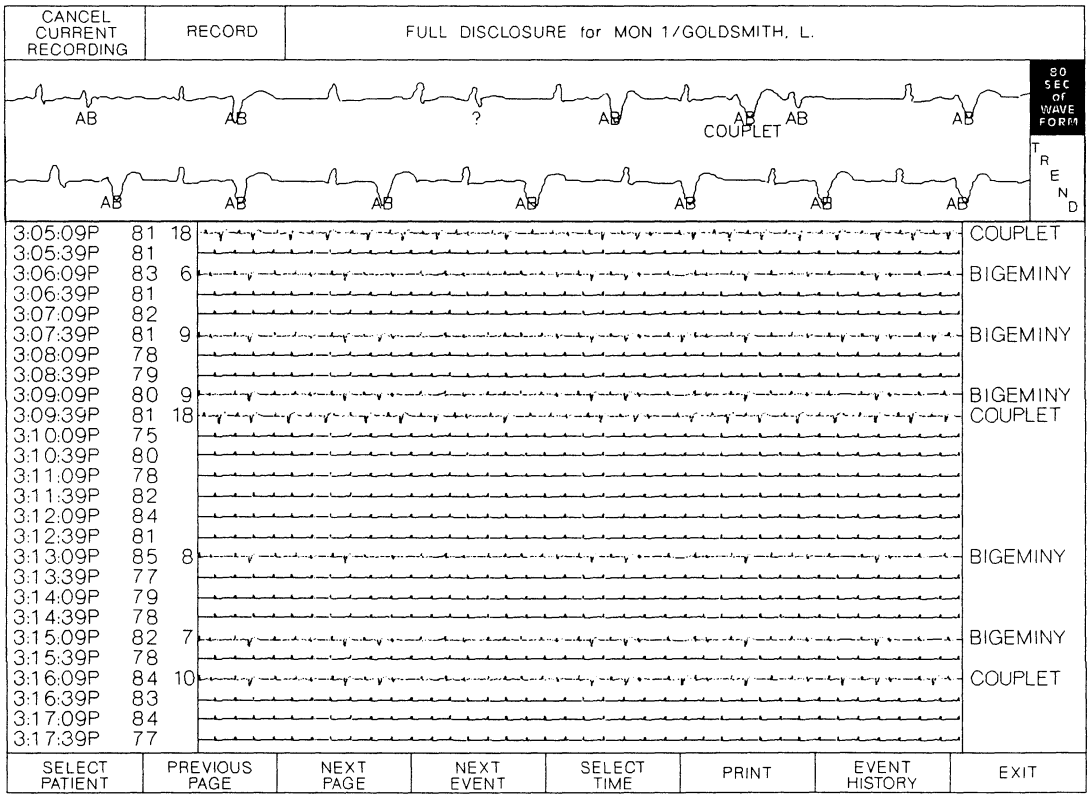
Touch any part of the compressed waveform to move the yellow bar and display the selected segment. Either 20 or 80 seconds of expanded waveform can be displayed with beat and event labeling.

TYPE OF EVENT	LABEL
Abnormal	AB
Premature Normals	PN
Paced	P
AVPaced	AVP
Missed Beat	MISSED
High Abnormal	HI ABNORMAL
Asystole	ASYSTOLE
Vfib	VFIB
Run	RUN
Couplet	COUPLET
High HR	HIGH HR
Low HR	LOW HR
Tachy	TACHY
Bigeminy	BIGEMINY
Trigeminy	TRIGEMINY
Slow Run	SLOW RUN

Table 4-5. Event Labels

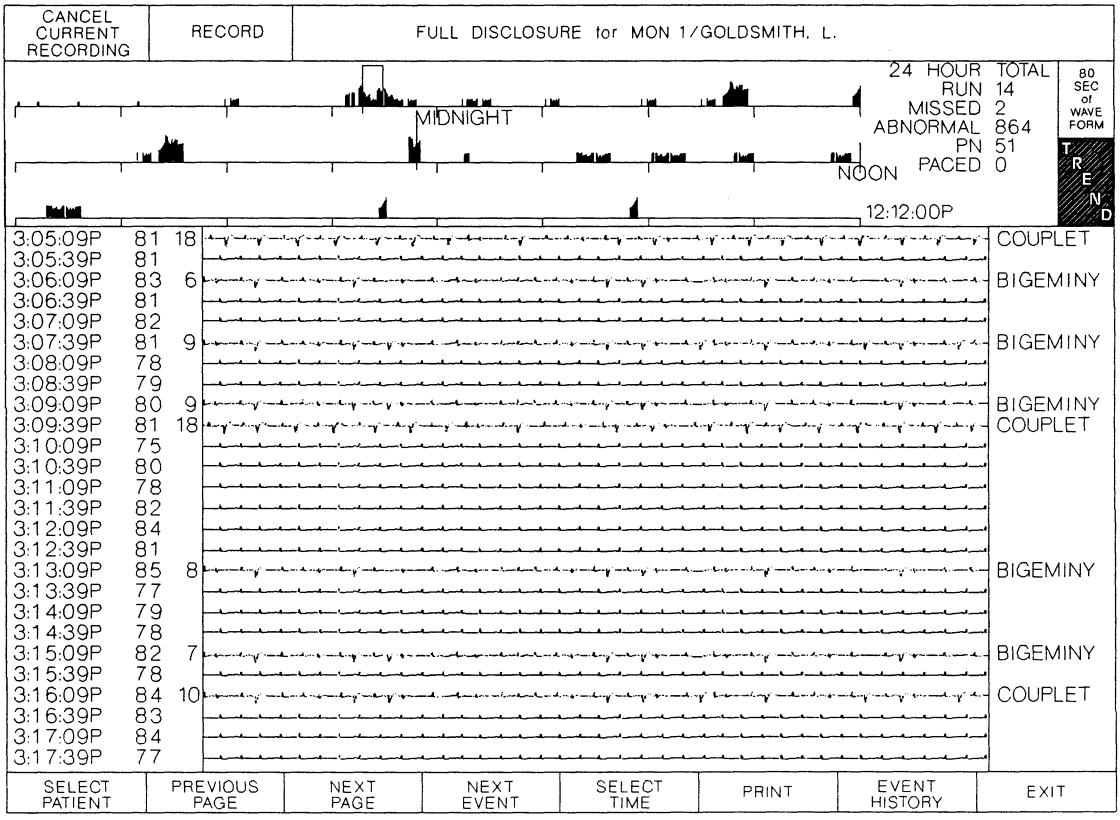
20 OR 80 SECONDS OF WAVEFORM

Touch 20 (80) SEC of WAVEFORM to toggle between the two formats.



TREND

Touch TREND to display the 24 hour bar graph of abnormals. Tabular totals of RUNS, MISSED BEATS, ABNORMALS, PREMATURE NORMAL BEATS, and PACED BEATS appear next to the bar graph.



A yellow time cursor defines the segment of compressed waveform currently displayed. Touch any area on the 24 hour trend plot to display the associated compressed waveform for that time period.

RECORD

Touch RECORD to generate a recording of the expanded waveform.

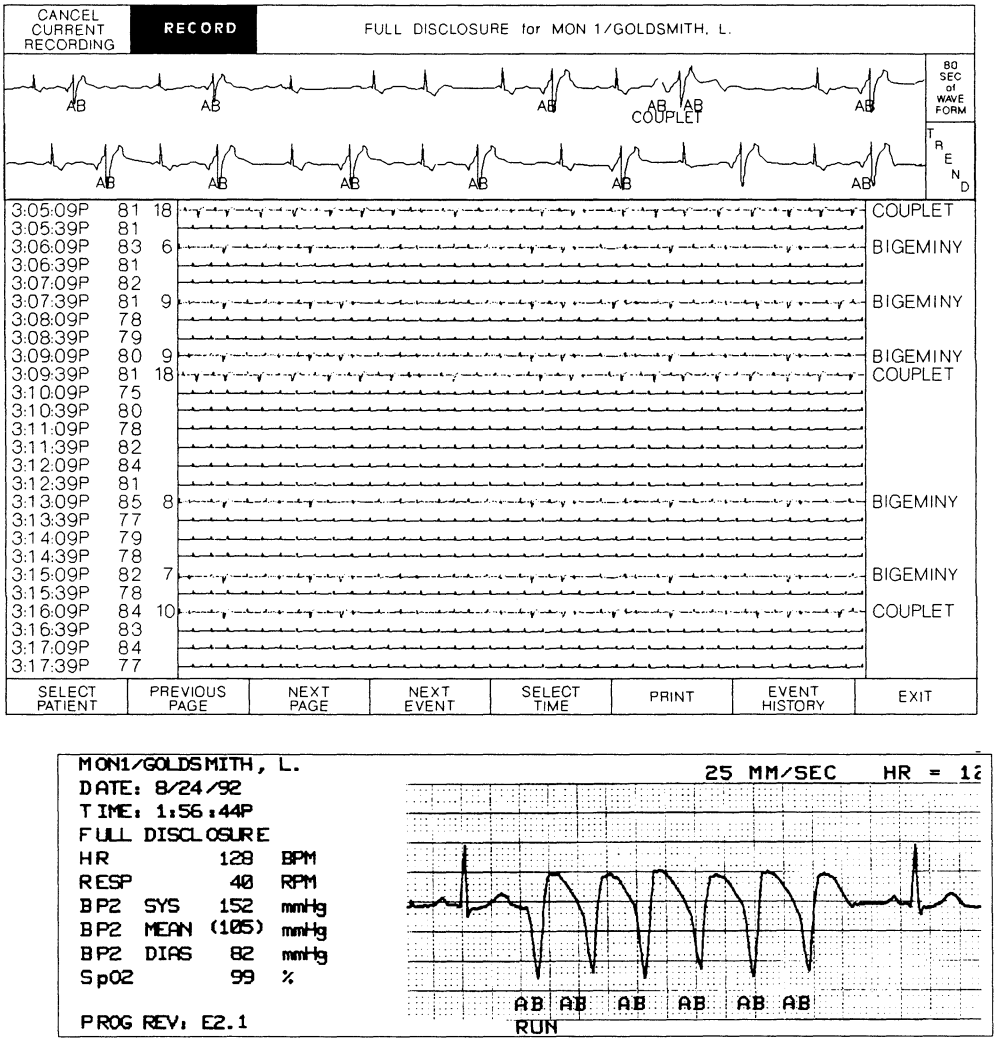
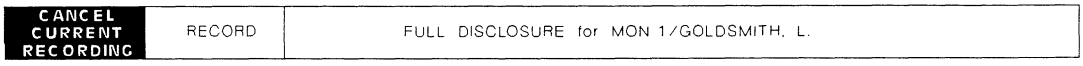


Figure 4-4. Arrythmia Waveform Recording

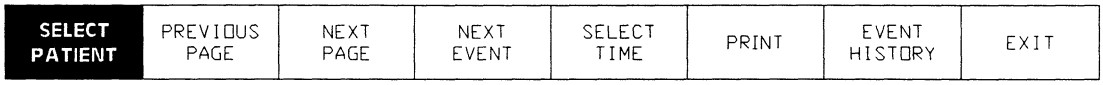
CANCEL CURRENT RECORDING

Touch CANCEL CURRENT RECORDING to stop a recording in progress.



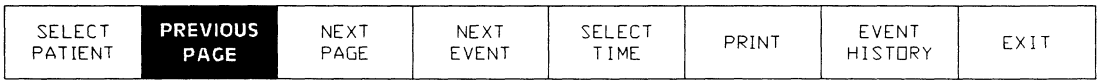
SELECT PATIENT

Touch SELECT PATIENT to display Full Disclosure for a new patient.



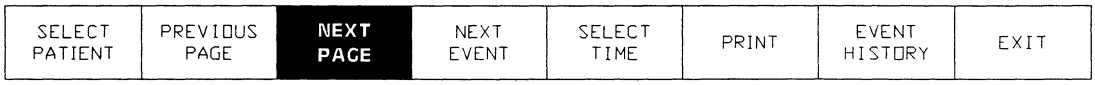
PREVIOUS PAGE

Touch PREVIOUS PAGE to display the previous 13 minutes of compressed waveform.



NEXT PAGE

Touch NEXT PAGE to display the next 13 minutes of compressed waveform.



NEXT EVENT

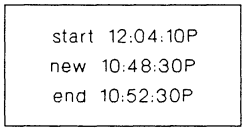
Touch NEXT EVENT to automatically move the cursor to the next event.

SELECT TIME

Touch SELECT TIME to enter a specific time for compressed waveform display.

SELECT PATIENT	PREVIOUS PAGE	NEXT PAGE	NEXT EVENT	**SELECT TIME**	PRINT	EVENT HISTORY	EXIT

A window displaying the start, new, and end time appears.



DISPLAY NEW TIME	HOUR INC	HOUR DEC	MIN INC	MIN DEC	AM/PM	CANCEL	EXIT

DISPLAY NEW TIME

Touch DISPLAY NEW TIME to display the new 13 minutes of compressed waveform.

DISPLAY NEW TIME	HOUR INC	HOUR DEC	MIN INC	MIN DEC	AM/PM	CANCEL	EXIT

PRINT

Touch PRINT to print a page of Full Disclosure compressed waveform or expanded waveform.

SELECT PATIENT	PREVIOUS PAGE	NEXT PAGE	NEXT EVENT	SELECT TIME	**PRINT**	EVENT HISTORY	EXIT

Select between PRINT ALL, PRINT HOUR, PRINT MARKED, or PRINT CANCEL to generate full page documents.

Touch PRINT ALL to print up to 24 hours of waveforms on compressed, 1 hour pages.

	PRINT ALL	PRINT HOUR	PRINT MARKED		PRINT CANCEL	EXIT

Touch PRINT HOUR to print a page of compressed waveform from the current hour displayed. If 2 hours are displayed, then both hours will print.

	PRINT ALL	**PRINT HOUR**	PRINT MARKED		PRINT CANCEL	EXIT

Touch PRINT MARKED to print a page of 50 second expanded waveforms.

	PRINT ALL	PRINT HOUR	**PRINT MARKED**		PRINT CANCEL	EXIT

Touch PRINT CANCEL to stop any additional pages from being printed.

	PRINT ALL	PRINT HOUR	PRINT MARKED		**PRINT CANCEL**	EXIT

EVENT HISTORY

Touch EVENT HISTORY to display the Event History screen.

SELECT PATIENT	PREVIOUS PAGE	NEXT PAGE	NEXT EVENT	SELECT TIME	PRINT	**EVENT HISTORY**	EXIT

4.3 ARCHIVE

The following section applies if your **ESCORT-LINK** includes the option for Archival.

Introduction

The archival option consists of a diskette drive through which vital sign trend data can be stored. Archived trend data can be analyzed either off line on another PC or loaded back into the **ESCORT-LINK** Central Station for retrospective display or printing of trend plots. Archived files are each labeled with the monitor/patient ID and time/date of storage.

3 PARAMETERS PER MONITOR	6 PARAMETERS PER MONITOR
26 Patients per Disk	13 Patients per Disk

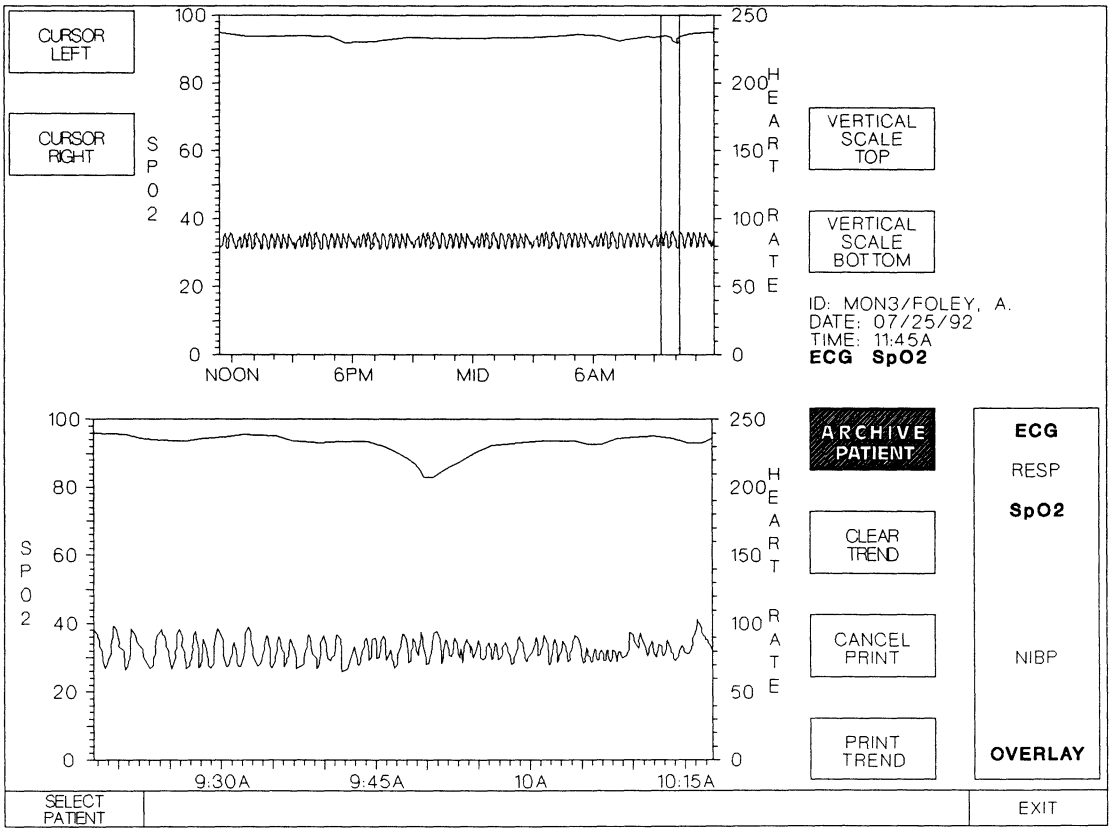
Table 4-5. Archive Disk Capacity

Using the Menu Keys

ARCHIVE STORAGE

From the Trend Data screen, the **ESCORT-LINK** Archive option allows you to store the trend data on diskette for paperless documentation or later retrieval.

Touch ARCHIVE PATIENT.



Touch ARCHIVE PATIENT again to store only the trend data on the selected patient.

Touch ARCHIVE ALL to store all the trend data on all patients.

Caution: To store Trend Data, use only Archive formatted diskettes. Do not use System Diskettes to store Trend Data.

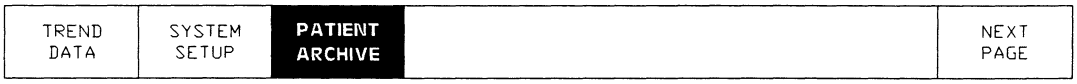
NOTE The Archival of trend data for all patients can take up to 4 minutes.

PATIENT ARCHIVES

Touch NEXT PAGE in the main menu to display the second menu.

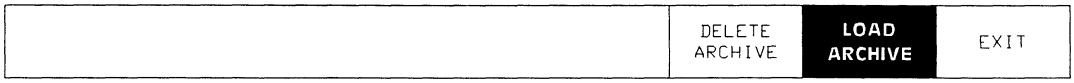
NOTE: Insert the diskette containing archive files, label-side up, into the Archive drive located above the single channel recorder on the **ESCORT-LINK** Central Station base. Confirm that it locks into place with a click.

Touch PATIENT ARCHIVES to display the archive choices, DELETE ARCHIVE and LOAD ARCHIVE.



LOAD ARCHIVE

Touch LOAD ARCHIVE to display the list of patient files contained on the diskette. Touch the key adjacent to the archive trend file to be displayed.



DELETE ARCHIVE

Touch DELETE ARCHIVE to display the list of patient files contained on the diskette. Touch the key adjacent to the archive trend file to be deleted.

You must confirm your intent in response to the question, "ARE YOU SURE YOU WANT TO DELETE THE MARKED FILE?". Touch YES to proceed.

4.4 HEWLETT-PACKARD LASERJET IIIP

The following section applies if your **ESCORT-LINK** Central Station includes the optional Hewlett-Packard LaserJet IIIP printer.

Introduction

Information such as trend plots, full disclosure waveform, full scale waveform, and archived trend plots can be printed through the LaserJet IIIP.

Refer to the Hewlett-Packard User's Manual and other documentation provided with your LaserJet IIIP for instructions on installation.

Patient data can be reviewed on screen and printed for inclusion in the patient's permanent record. Information found in Trend, Full Disclosure, and Archived Trend is accessible through each respective menu key. Information on each Print key may be found in

- Section 3.6, "*Trend Data*,"
- Section 4.2, *"Full Disclosure*,"
- Section 4.3," *Archive*."

5. TROUBLESHOOTING

This chapter presents a troubleshooting guide for potential mechanical and clinical problems by listing the problem, possible causes of the problem, and possible solutions for the problem. If, after attempting all possible solutions, the problem still exists, contact the appropriate service personnel.

WARNING: Removing chassis cover will expose high voltage and a potential for shock. Only qualified personnel should attempt disassembly of the ESCORT-LINK Central Station display or base unit.

5.1 GENERAL

PROBLEM	POSSIBLE CAUSE	POSSIBLE SOLUTIONS
Screen is blank.	Power is not turned on.	Turn video screen power ON; turn PC base power ON.
		Confirm that AC power cords are securely plugged into equipment and AC power source.
	Screen is not properly adjusted.	Adjust screen contrast and brightness.
	Connector cables are loose.	Confirm display cable is connected to base unit.

PROBLEM	POSSIBLE CAUSE	POSSIBLE SOLUTIONS
Central Station is not .	Power is not turned on.	Turn video screen power ON; turn PC base power ON. Confirm that AC power cords are securely plugged into equipment and AC power source.
	System diskette is not installed.	Confirm that system diskette is installed (if unit has Full Disclosure option, this is not necessary).
	Diskette is not properly inserted.	Remove diskette, reinsert, and reboot system.
	Improper diskette is being used.	Confirm that diskette is an MDE **ESCORT-LINK** system diskette.
Touchscreen does not function.	Touchscreen cable has become loose.	Reconnect touchscreen cable on both the PC base and video screen.
	Screen is out of calibration.	Recalibrate touchscreen by rebooting the system.

PROBLEM	POSSIBLE CAUSE	POSSIBLE SOLUTIONS
No recording on strip.	Recorder is out of paper.	Remove old paper cylinder and install new roll of paper.
	Recorder is not printing.	Confirm that paper is loaded correctly, with end of paper exiting from under the roll.
		Confirm that MDE-approved paper (model no. E2700-32 or equivalent) is in use.
	Paper is jammed.	Verify that paper is properly loaded, and not caught in door.

5.2 COMMUNICATION

PROBLEM	POSSIBLE CAUSE	POSSIBLE SOLUTIONS
NO COMM message at Central Station for a specific monitor **COMM OK indicator at bedside monitor is off or is flashing.** **Patient monitor waveform and parameter values are not displayed at Central Station.**	Inadequate signal between bedside and Central Station.	Verify that antenna on bedside monitor is securely attached. Verify that monitor is within range of the central antenna system. Verify that no interfering walls, equipment, or metal/mesh windows are between the monitor and Central Station antenna
NO COMM message at Central Station for all monitors.	Inadequate signal received at Central Station.	Verify that the Central Station antennae is securely attached.

5.3 ARRHYTHMIA

PROBLEM	POSSIBLE CAUSE	POSSIBLE SOLUTIONS
False Event Classifications.	A noisy ECG signal causing false event detection and classification due to muscle, motion, or electrical artifact.	Ensure that the ECG signal is as clean as possible by using good setup and lead placement techniques. If the ECG is persistently noisy, check the electrodes, lead wires, and patient cable for possible failure. Minimize any possible muscle, motion, or electrical artifact.
	Lead change or change in patient's rhythm has changed the learned dominant beat.	Have the Central Station relearn the current dominant rhythm.

PROBLEM	POSSIBLE CAUSE	POSSIBLE SOLUTIONS
False Event Classifications (continued).	T-waves and/or P-waves are being detected and classified.	Select a lead that maximizes the R-wave and results in P-waves and T-waves no larger than 3mm on the recorder. Have the Central Station relearn the ECG after making adjustments. Reduce the ECG size with the bedside control. Have the Central Station relearn the ECG after making adjustments.
	Arterial fibrillation or flutter are difficult rhythms. The frequent rate changes and distortion of the QRS may result in misclassification of beats and events.	Adjust limits to minimize false Run, Missed Beat, and Tachy classifications.

PROBLEM	POSSIBLE CAUSE	POSSIBLE SOLUTIONS
Missed event detection.	Some beats do not meet the algorithm's criteria for classified abnormal, even though a clinician may consider it abnormal.	No action required. All arrythmia detection algorithms must make tradeoffs to minimize false alarms. No algorithm has 100% sensitivity to abnormal beats.
	All of the beats in the observed event do not meet the criteria for that type of event.	Adjust the limits to be more sensitive to the type of event in question, and/or have the Central Station relearn the dominant beat.
	All of the beats in the observed event were not detected. Beats less than 3mm in amplitude will not be detected. Beats greater than 4cm in amplitude may trigger the artifact rejection test. Very wide beats may be missed due to their low frequency content.	Adjust the size of the QRS to 1 - 2cm on the bedside monitor. If a very wide beat is consistently being missed, select a lead on which the abnormal beat is not as wide.

PROBLEM	POSSIBLE CAUSE	POSSIBLE SOLUTIONS
Failure to alarm, save, or record an event.	Arrythmia is not ON for the patient.	Verify the setup for this patient. Ensure that the proper keys are ON and limits are set appropriately.
	Event limits are set to inappropriate values.	Verify the setup for this patient. Ensure that the proper keys are ON and limits are set appropriately.
	Desired event keys are not turned ON in the Arr/Alarm Setup.	Verify the setup for this patient. Ensure that the proper keys are ON and limits are set appropriately.
	All the beats in the event did not meet the algorithm's criteria for classifying that event.	If the 24 hour Full Disclosure option is available, verify the classification of beats in the event.

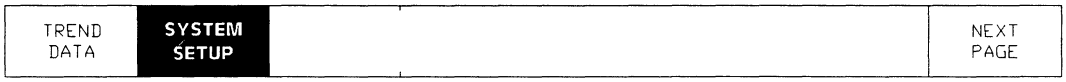
6. SYSTEM SETUP

WARNING: The ESCORT-LINK Central Station is intended for use as an adjunct in assessing a patient's condition. The ESCORT-LINK must be used in conjunction with assessment of a patient's clinical symptoms.

WARNING: Carefully read this Operator's Manual before attempting clinical use of the ESCORT-LINK Central Station.

The System Setup key accesses a group of functions that deal with the entire system. These functions allow setup of system default configurations, date, time, and review of Power Level transmissions.

Touch SYSTEM SETUP.



6.1 CONFIGURING THE SYSTEM

System configuration should be performed by qualified personnel only.

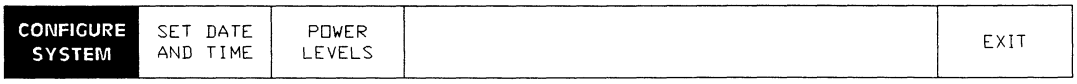
WARNING: When configuring the system, all patient monitoring ceases.

Introduction

The **ESCORT-LINK** Central Station is configurable. Configuration defines display format, which monitors are to be displayed, and configurable default alarm conditions and levels.

Using the Menu Keys

Touch CONFIGURE SYSTEM. Touch and hold YES for 2 seconds.



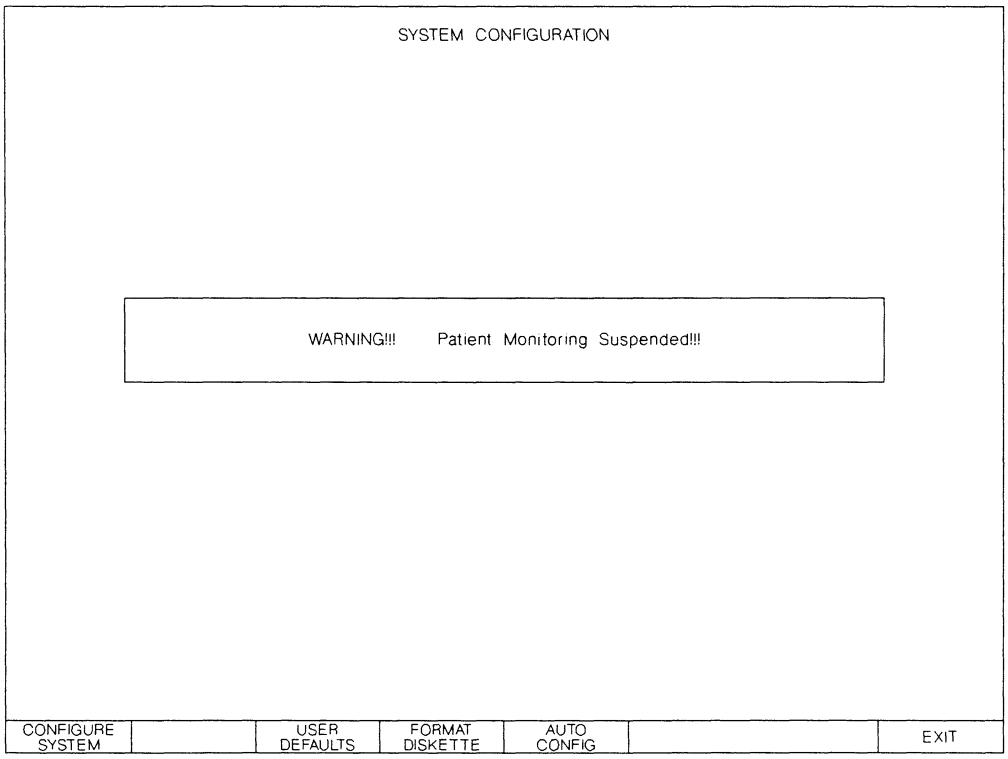
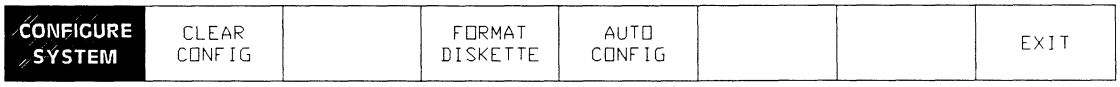


Figure 6-1. Configuration Screen

CONFIGURE SYSTEM



Touch CONFIGURE SYSTEM to continue configuration of the system.

MONITOR ID NAME ASSIGNMENT

ESCORT bedside monitors are physically numbered with a unique address from 1 to 32. Using the menu keys, assign a name to each monitor or designate it as unused.

- Touch ASSIGN NAME to display the keyboard which allows you to enter the monitor name/ID.

- Touch MONITOR NOT USED to erase monitor ID and label the monitor address as "not used".

WARNING: To ensure positive monitor identification, the bedside monitor ID entered during configuration must match the ID name on the monitor ID tag. Use room numbers only if you are absolutely certain of fixed monitor locations. It is recommended that you use monitor ID names that are not location specific.

NOTE: Every monitor in use must be assigned a name/ID.

- Touch NEXT MONITOR to increment monitor address number.

- Touch PREVIOUS MONITOR to decrement monitor address number.

- Touch ALL NOT USED to clear all monitor ID names.

- Touch EXIT to move to the next screen.

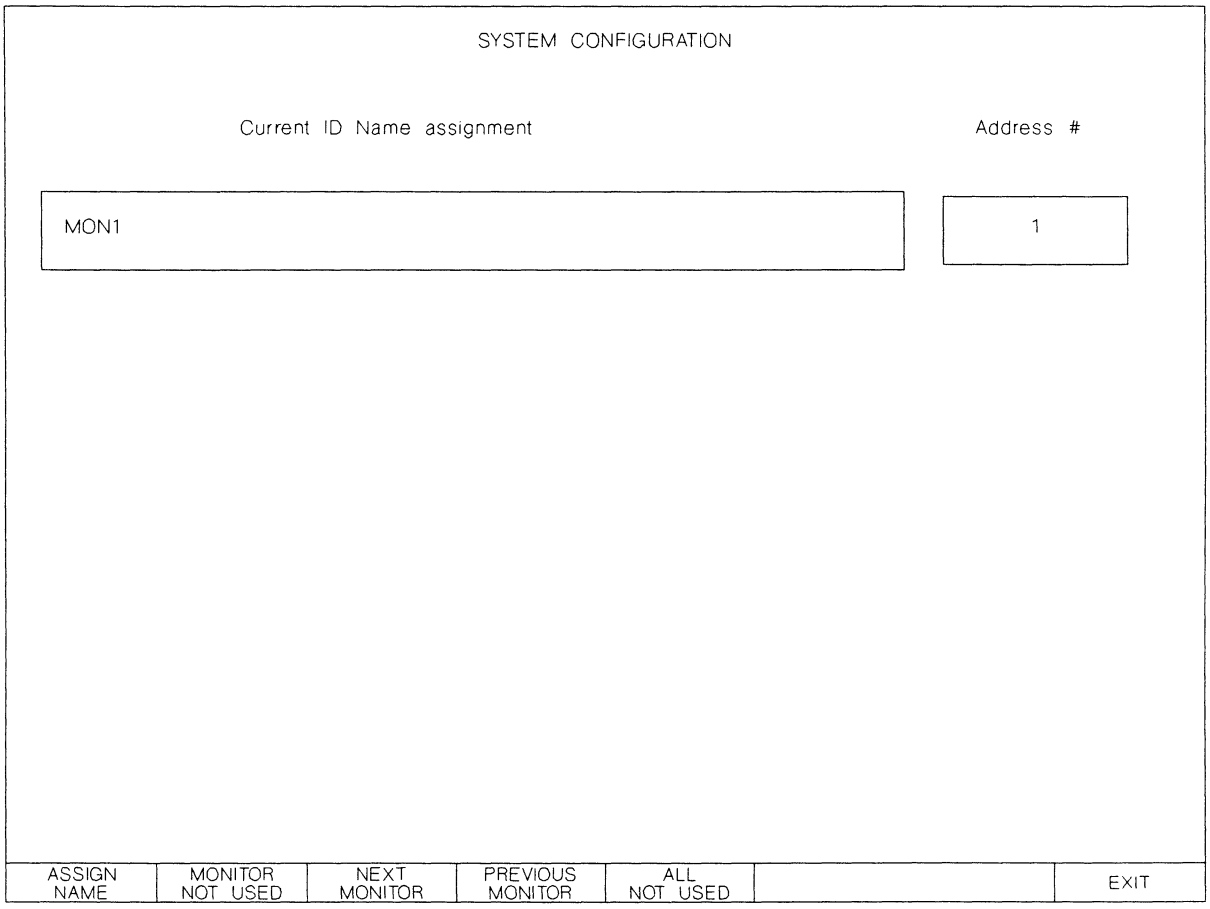


Figure 6-2. Monitor ID Name Assignment Screen

PARAMETER POSITION ASSIGNMENT

Parameter tiles display numerical values for monitored parameters. There are six positions in which parameters can be placed. Select names from the list of 14 parameter names. All positions must have names assigned.

- Touch a parameter name on the Parameter Names list.
- Touch one of the six parameter locations to assign the name to that position.
- Continue assigning parameters to each of the six positions, using "NO PARAMETER" to fill any unused parameter positions.
- Touch EXIT to display the next screen.

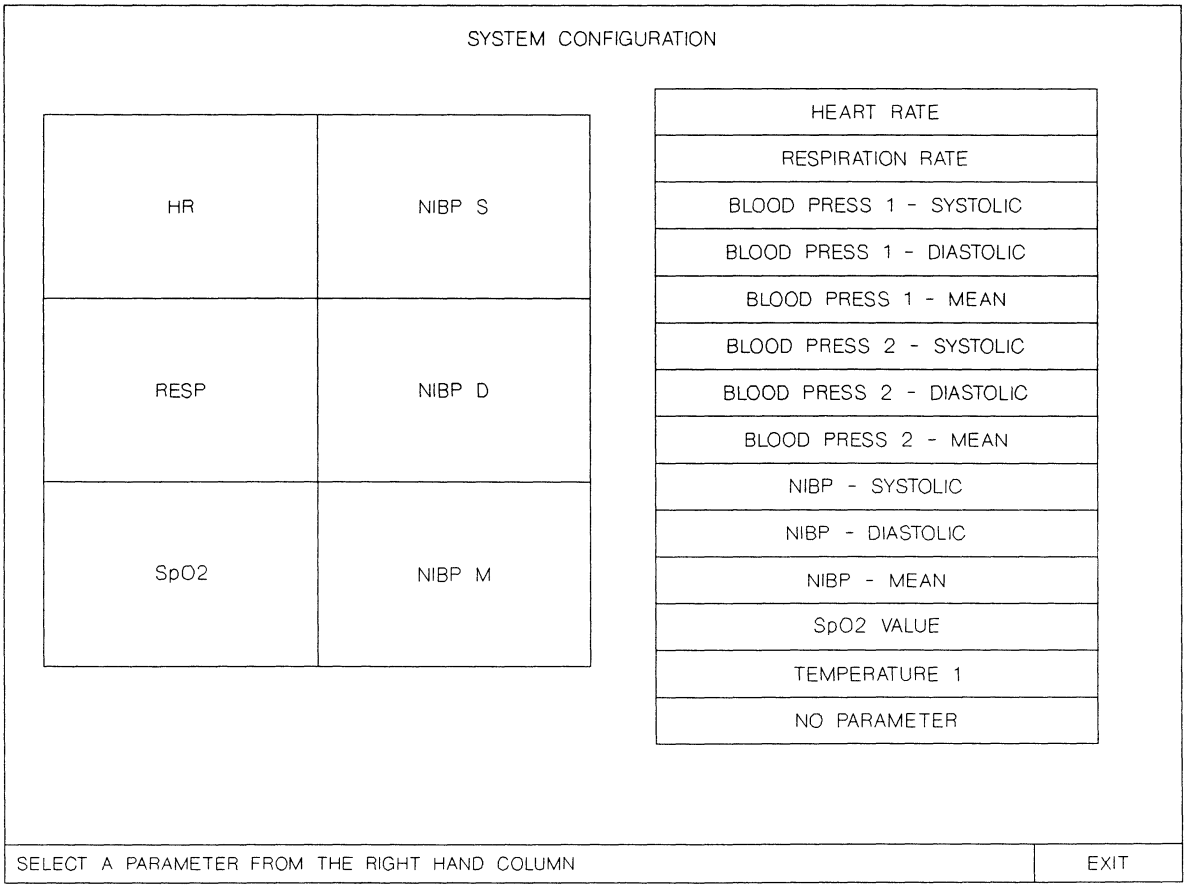


Figure 6-3. Parameter Position Assignment Screen

DEFAULT WAVEFORM ASSIGNMENT

The power-up default waveform type must be assigned. Five types of waveforms are available. Select either ECG, Blood Pressure 1, Blood Pressure 2, SpO_2 Pleth, or Respiration, depending upon the application and configuration of the bedside monitors.

- Touch the default waveform type.
- Touch EXIT to move to the next screen.

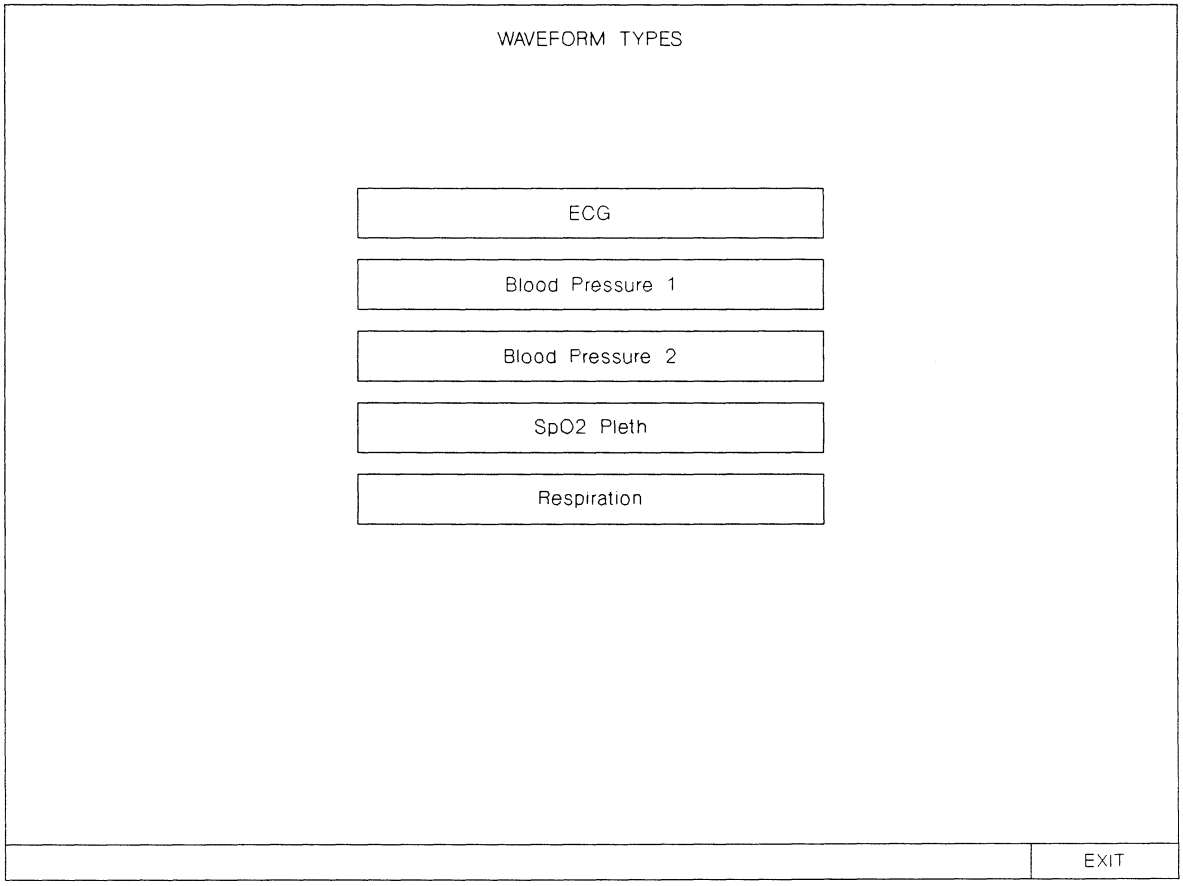


Figure 6-4. Waveform Type Assignment Screen

OVERVIEW TILE POSITION ASSIGNMENT

Overview tiles are used to display patient alarm status for up to 8 patients in one tile. Up to four Overview tiles can be assigned.

- Touch tile position to assign an Overview tile.
- Touch existing Overview tiles to remove them.

NOTE: Removing an Overview tile will unassign any **ESCORT** monitor assigned to it. Assigning an Overview tile to a tile already assigned will reassign the tile to Overview.

- Touch EXIT to move to the next screen.

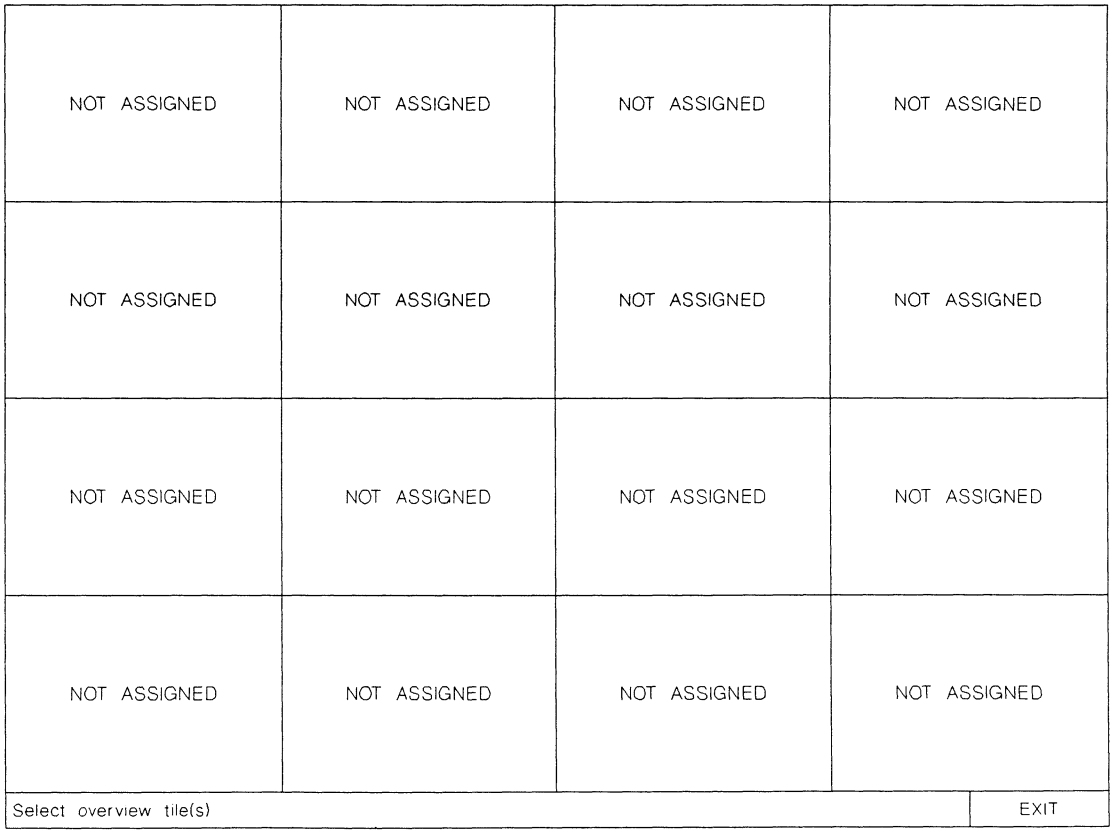


Figure 6-5. Overview Tile Position Assignment Screen

TILE POSITION ASSIGNMENT

Bedsides can be assigned to tiles that are Not Assigned. If the desired location is currently filled by another monitor, first remove that monitor.

NOTE: All **ESCORT** monitors that have been assigned a name must be assigned a position on the screen.

- Touch ASSIGN BEDSIDE and a tile to assign the specified monitor to that location.
- Touch REMOVE BEDSIDE to remove the monitor from the screen.
- Touch NEXT MONITOR to specify the next monitor number.
- Touch ASSIGN WAVEFORM to assign a waveform to the adjacent parameter tile.
- Touch REMOVE WAVEFORM to remove a waveform.
- Touch EXIT to move to the next screen.

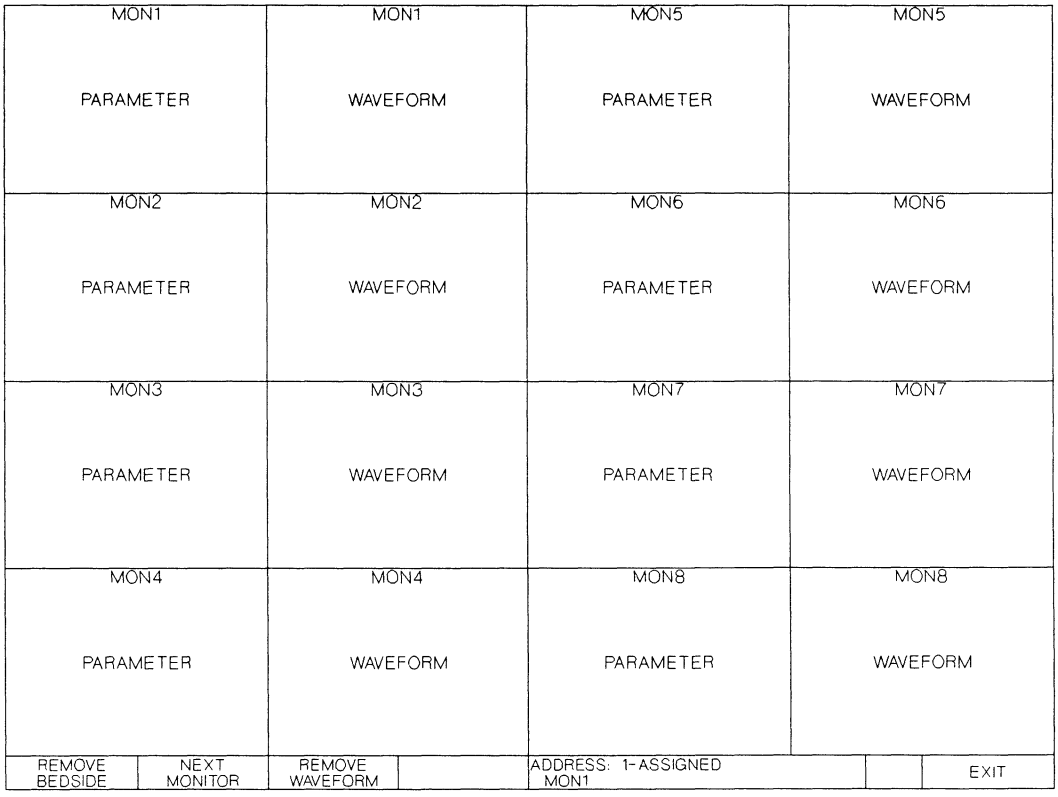


Figure 6-6. Tile Position Assignment Screen

ALARM DEFAULT SETUP

The default record protocol and alarm settings can either be user configured or configured with the factory default values.

- Touch FACTORY DEFAULTS to turn Record OFF, Save ON, and set Level 1 for all parameters.

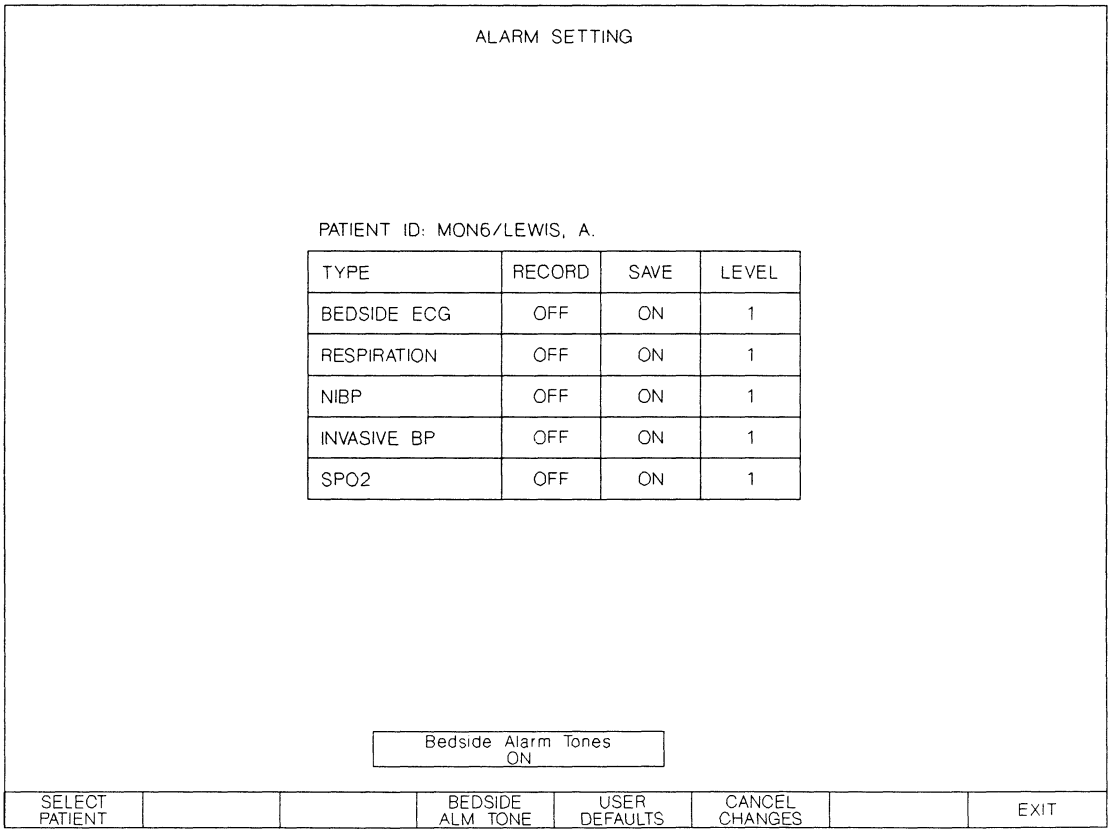


Figure 6-7. Alarm Defaults Setup Screen (Without Arrythmia Option)

RECORD: When ON, records the displayed waveform each time the event is detected. Recordings are at least 20 seconds or for the duration of the event.

SAVE: When ON, stores 20 seconds of waveform in Event History each time the event is detected.

LEVEL: 1, 2, or 3 defines the seriousness and priority of the alarm event. Level 1 alarm events have priority over Level 2 and 3 events. Level 2 alarm events have priority over Level 3 events. Higher level events will override concurrent lower level event alarm messages.

If the system contains the Arrhythmia option, arrhythmia default settings can also be programmed.

- Touch ON or OFF to toggle between the two.
- Touch EXIT to move to the next screen.

Arrhythmia/Alarm Settings

PATIENT ID: MON6/LEWIS, A.

TYPE	RECORD	SAVE	HOLD	ALARM	LEVEL	LIMIT		
ASYSTOLE	OFF	ON	ON	ON	1			
VFIB	OFF	ON	ON	ON	1			
RUN	OFF	ON	ON	ON	1	3	↑	↓
MISSED BEAT	OFF	ON	ON	ON	1	1.8	↑	↓
COUPLET	OFF	ON	ON	ON	2			
HI HR	OFF	OFF	OFF	OFF	2	150	↑	↓
LO HR	OFF	OFF	OFF	OFF	2	50	↑	↓
HI ABNORMAL	OFF	OFF	OFF	OFF	2	10	↑	↓
TACHY	OFF	OFF	OFF	OFF	2	8	↑	↓
BIGEMINY	OFF	OFF	OFF	OFF	2			
TRIGEMINY	OFF	OFF	OFF	OFF	2			
SLOW RUN	OFF	OFF	OFF	OFF	2	10	↑	↓
BEDSIDE ECG	OFF	ON			1			
RESPIRATION	OFF	ON			1			
NIBP	OFF	ON			1			
INVASIVE BP	OFF	ON			1	Arrhythmia Processing ON		
SPO2	OFF	ON			1	Bedside Alarm Tones ON		

SELECT PATIENT	RELEARN	STANDBY	BEDSIDE ALM TONE	USER DEFAULTS	CANCEL CHANGES	ARR ON/OFF	EXIT

Figure 6-8. Arrythmia/Alarm Defaults Screen

RECORD: When ON, records the displayed waveform each time the event is detected. Recordings are at least 20 seconds or for the duration of the event.

SAVE: When ON, stores 20 seconds of waveform in Event History each time the event is detected.

HOLD: When ON, displays the most recent event of that type below the real time ECG trace in the waveform tile accompanied by the time of the event and the current abnormal beats per minute (ABN/MIN).

ALARM: When ON, enables the audible alarm tone and visible alarm message.

LEVEL: 1, 2, or 3 defines the seriousness and priority of the alarm event. Level 1 alarm events have priority over Level 2 and 3 events. Level 2 alarm events have priority over Level 3 events. Higher level events will override lower level event alarm messages, tones, and held waveforms.

Level of Alarm	Audible Tone	Visual Message
1 - Most Serious (Life Threatening)	Modulated - High/Low Once per second	Flashing Red - Once per second
2 - Serious	Once per second	Flashing Yellow - Once per second
3 - Informational	Once every 4 seconds	Continuous Yellow

Table 6-1. Alarm Levels

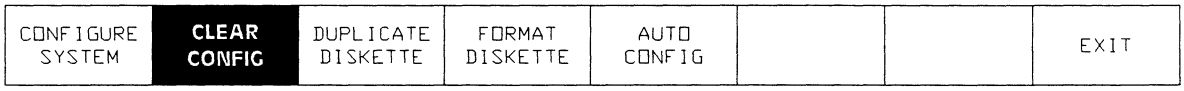
LIMIT: Adjustments may be made for certain event types using the ↑ and ↓ keys. Increments for each event to which adjustments can be made are listed in Table 6-2.

EVENT	LIMIT RANGE MIN - MAX	INCREMENT
RUN	3 - 10	1
MISSED BEAT	1.5 - 3.0	0.1
HEART RATE (High)	50 - 250	5
HEART RATE (Low)	30 - 150	5
ABNORMAL RATE (High)	0 - 20 20 - 100	1 5
TACHY	1 - 10	1
SLOW RUN	3 - 10	1

Table 6-2. Event Limits

CLEAR CONFIGURATION

Touch CLEAR CONFIG to delete the current system configuration.



Only use this function if you plan to make major changes in the configuration. Touch YES to confirm your choice.

FORMAT DISKETTE

Touch FORMAT DISKETTE to access System Diskette Drive and Archive Diskette Drive (optional) keys. After selecting a drive, insert a blank floppy diskette into the appropriate drive. Touch OK to proceed with formatting process.

WARNING: Formatting a diskette will erase any data stored on the disk.

NOTE: Before inserting the diskette, confirm that it is not write-protected (notch on the same side of the disk as the arrow must be closed).

AUTO CONFIGURATION

Touch AUTO CONFIG to choose between a 4, 6, 8, 12, 16, 23, or 31 bed configuration with factory configured default alarm values.

6.2 DATE AND TIME

Introduction

The Set Date and Time screen allows adjustment of the Month, Day, Year, Hour and Minute for the system clock. Enter hours in military time. Choose display and format as either Month/Day/Year, or Day/Month/Year, and choose either 12 or 24 hour clock.

Using the Menu Keys

Touch SET DATE AND TIME.

- Touch the arrow keys to make desired changes.
- Touch DATE IS.. to set date display for month/day/year (MM/DD/YY) or day/month/year (DD/MM/YY) format .
- Touch TIME IS.. to set time display for 12 hour clock (12HR CLK) or 24 hour clock (24HR CLK) format.
- Touch SET and confirm your decision by touching YES in response to the question, "PLEASE CONFIRM: SET SYSTEM TIME?."

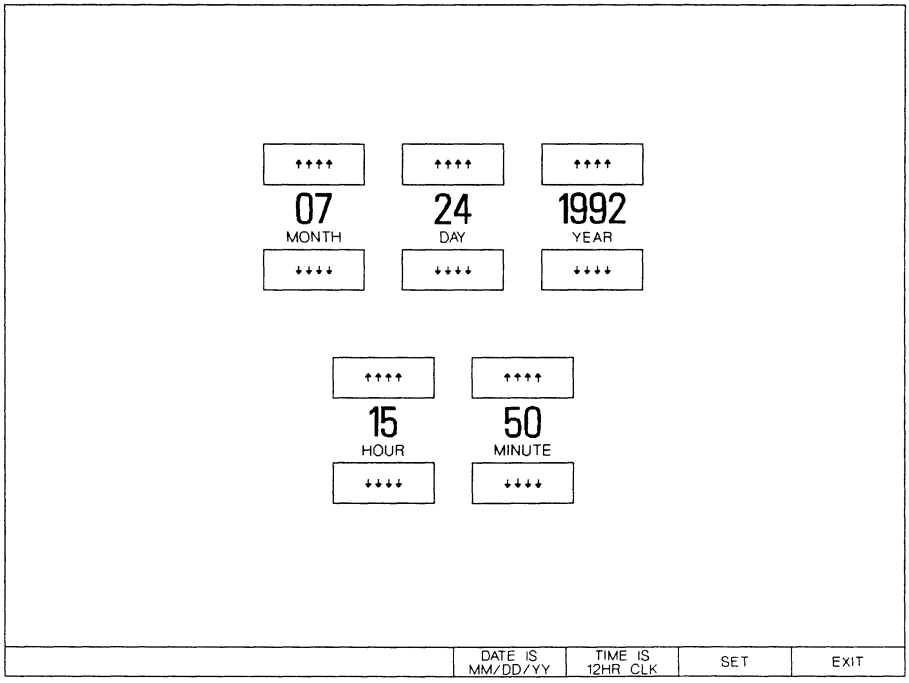


Figure 6-9. Set Time and Day Screen

6.3 POWER LEVELS

Introduction

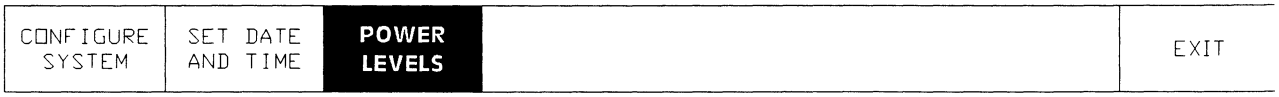
The Power Level screen provides a graphic indication of RF signal strengths for each monitor. Signal strength updates occur every 2.25 seconds. Signal strength is represented by a green bar, with a solid green bar representing maximum strength. For reliable coverage, the green bar should be at least halfway across the scale.

If an alarm violation occurs, an alarm message displays on the Power Level screen indicating the monitor/patient ID and parameter in violation. Multiple alarm violations display one at a time in rotation.

Messages such as "Low Battery" and "Alarm Suspend" appear to the right of the remote power level indicator scale. If the system contains the Arrhythmia option, the arrhythmia event classification is displayed.

Using the Menu Keys

Touch POWER LEVELS.



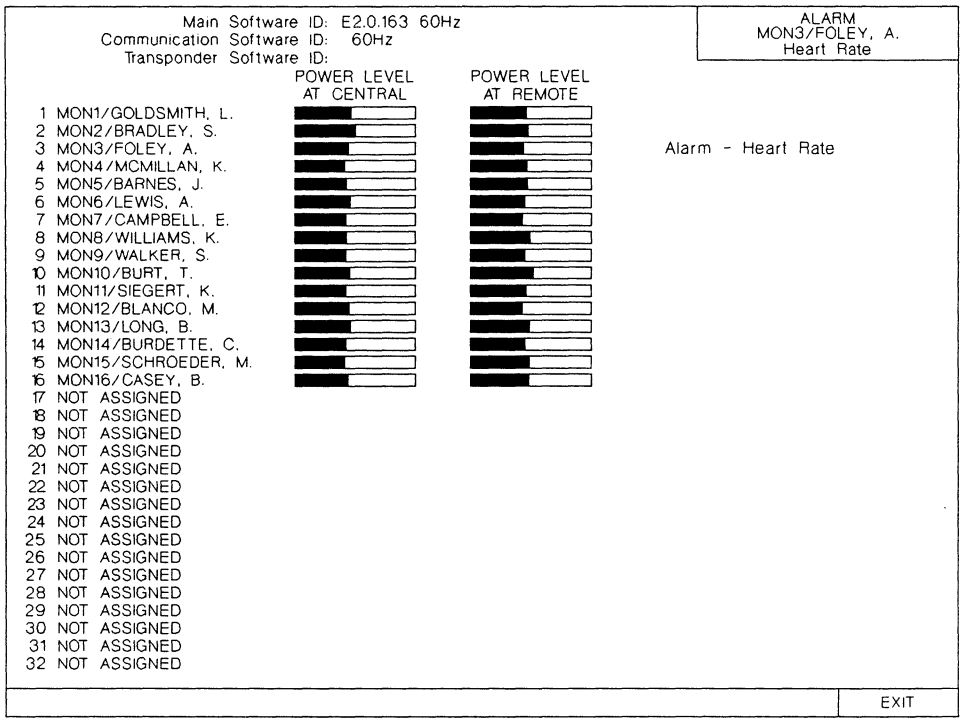


Figure 6-10. Power Level Screen

7. CARE AND MAINTENANCE

The **ESCORT-LINK** should be located in an area that allows free circulation of air and away from possible sources of electrical interference and excessive heat. A battery backup (UPS) is recommended to prevent system resets during brief power outages or testing of hospital backup power systems.

The **ESCORT-LINK** Central Station should be cleaned with a lint free cloth slightly dampened. Avoid harsh cleaning solutions which might harm the plastic surfaces or metal finish. A glass cleaner or a non-alcohol based solvent is recommended. If unsure about the cleaning solution, apply a small amount to the cloth and test an area on the side of the base unit housing. If no damage is done to the housing finish, proceed cautiously with the rest of the unit.

WARNING: Do not immerse the cables or electrical connectors during cleaning. Do not allow liquid to enter the switches, cable entrances, or electrical connectors.

Visual inspection of the mechanical integrity of all cables and power cords should be performed regularly.

Biomedical inspection should be performed to check for acceptable equipment performance and electrical safety according the the protocol set forth by the institution.

Refer all corrective maintenance needs to qualified service personnel. Do not attempt to remove the housing to remedy a problem unless qualified to do so.

8. REFERENCE

8.1 ACCESSORIES

MODEL NO.	DESCRIPTION
E2700-10	Wall Mount (Complete) (GCX#VB5P-01)
E2700-34	Wall Mount (Less wall channel) (GCX#VB5P-13)
E2700-35	6" Wall Mount Utility Basket (GCX#PS-WB6)
E2700-11	Rolling Stand (GCX#RS5P)
E2700-36	6" Rolling Stand Utility Basket (GCX#RS-WB6)
E2700-32	Recorder Paper (box of 10 rolls)
E2700-54	Recorder Paper (case of 100 rolls)
E2700-08	Archive to ASCII Database Program (3 1/2" diskette)
E2700-51	Uninterruptible Power Supply (110 volt, 60 Hz)
E2700-74	E3200A Power Isolation Transformer (ONEAC 240VA Medical Grade) (110 volt, 60 Hz)
E2700-55	E3200A Alarm Panel (110 volt, 60 Hz)
E2800-81	E3200A Display Extension Cable Kit (6 ft.)
E9030-01	**ESCORT 100/200** and **100T/200T** Operator's Manual, English
E9030-02	**ESCORT-LINK E3200A** Operator's Manual, English
E9030-05	**ESCORT 100** Series ***AT-A-GLANCE*** Reference Cards (3 sets), English
E9030-07	**ESCORT 100** Inservice Video (1/2" VHS), English
E9030-08	**ESCORT 100** Inservice Video (1/2" PAL), English
E9040-01	**ESCORT 100/200** and **100T/200T** Service Manual, English
E9040-02	**ESCORT-LINK E3200A** Service Manual, English
E9040-20	E3200A Spare Parts Kit Form
E9040-21	E3200A Spare Parts Chassis Form

8.2 PACK AND UNPACK

The **ESCORT-LINK** Central Station with integral single channel recorder, compatible with Arrhythmia and Full Disclosure Options, is shipped with the items listed in Table 8-1. When unpacked, care should be taken to confirm their receipt.

Quantity	Description
1	**ESCORT-LINK** Screen
1	**ESCORT-LINK** Computer Base
1	Antenna with coax cabling
2	Power cords
1	Touchscreen to base interface cable
1	Roll Thermal Paper
1	**ESCORT-LINK** Operator's Manual
1	**ESCORT-LINK** Service Manual
1	**ESCORT-LINK** Inservice Video
2	3 1/2" diskettes containing current software versions

Table 8-1. Items and Accessories Shipped

When the shipping containers for the **ESCORT-LINK** Central Station are received, they should be inspected for any external damage or stress. If damage to any of the boxes is noticed, the carrier should be notified immediately. All shipping boxes should be retained in the event that it is necessary to return any item to MDE.

The Central Station's base and screen should be removed from their shipping boxes and inspected for any physical damage. Bedside monitors, as well as accessories, should also be inspected.

If damage is found, contact the carrier directly. If, for any reason, any part of the **ESCORT-LINK** Central Station needs to be returned to the factory, a Return Material Authorization number (RMA #) should be obtained from the MDE Technical Support Department. Please specify the serial number of the unit and a description of why the unit is being returned.

NOTE: All returned units should be reshipped in their original shipping boxes and packing material.

8.3 SPECIFICATIONS

Display Type:	13" (33 cm) color, computer video display
Display Resolution:	VGA 640 x 480 pixels
Central Processor:	Standard PC 386, 33 MHz
Memory:	8 MB RAM; 200 MB HDD with Full Disclosure option
User Interface:	Touchscreen
Number of Patients Monitored:	1 to 32
Waveforms Displayed:	Up to 8 waveforms, selectable
Parameters Monitored:	HR, RR, SpO_2, IBP (SYS/DIAS/ MEAN), NIBP (SYS/DIAS/MEAN), T
Parameters Monitored /Patient:	Up to 6
Patient Data Display:	3 formats selectable depending on number of patients monitored: 1) Parameters, waveform, and alarm status 2) Parameters and alarm status only 3) Alarm status only
Alarm Response Time from Bedside:	4.5 seconds
Alarm Handling:	Central Station ALARM SUSPEND key temporarily suspends audible alarms for 3 minutes. Alarm limits are adjusted, enabled, and disabled via the bedside monitor.
Transceiver Frequency:	UHF 450-470 MHz; several network frequencies available, factory selected; one frequency per **ESCORT-LINK** network.
Transmission Power:	50 mW
Modulation:	FSK 18500 Hz/10900 Hz
Range:	450 ft. (137 m) outdoor line of sight 200 ft. (60 m) indoor line of sight 150 ft. (45m) through wood/concrete walls 75 ft. (22 m) through metal walls
Transmission Protocol:	Proprietary MDE digital LAN
Trending:	32 patients, 6 parameters per patient; 1 and 24 hour plots; 10 second sampling intervals; 1 hour windows selectable within last 24 hours.

RECORDER

Print Method:	Thermal Array
Channels:	Single
Resolution:	8 dots/mm vertical, 32 dots/mm horizontal
Paper:	40 mm grid; 50 mm paper width
Speed:	12.5, 25 mm/sec
Manual Record Duration:	20 seconds
Memory:	16 seconds
Annotation:	Time, date parameter values, bed ID, source, speed, abnormal events with arrhythmia option, software version

PHYSICAL

Weight:	Video display — 32 lbs. (14.5 kg) PC base — 31 lbs. (14.1 kg)
Size:	14. (H) x 13.75. (W) x 16.125. (D) — video display 35.6 cm (H) x 34.9 cm (W) x 41.0 cm (D) 6.75. (H) x 14. (W) x 16. (D) — PC base 16.9 cm (H) x 35.6 cm (W) x 40.6 cm (D)
Environment:	5 to 40$ C 0 to 90% humidity
AC Main:	115/230 Vac 10%; 60/50 Hz
Power:	300 watts
Certification:	FCC 90.217 UL 1950 and CSA

ARRHYTHMIA (Option 23L)

No. of Arrhythmia Channels:	1 to 8
Types of Detected Events:	Asystole, vfib, missed beats, run, couplet, high and low heart rate, high abnormal count, tachy, bigeminy, trigeminy, and slow run

Display:	Split screen showing the most recent alarm event below the real time ECG
Event History Storage:	100 events per patient; 20 seconds per event with 12 seconds preceding the event
Type of Algorithm:	Heuristic algorithm using template matching and feature extraction
Documentation:	Thermal array recorder

FULL DISCLOSURE (Option 24L)

Waveform Storage:	24 hours, one waveform from up to 8 patients
Waveform Display:	20 and 80 seconds expanded waveform with 13 minutes compressed waveform
Labeling:	Heart rate, abnormal count, alarm event
Trends:	All abnormals, premature normals, runs, missed and paced beats
Documentation:	Thermal array recorder or optional LaserJet IIIP printer

ARCHIVAL DATA STORAGE (Option 15L)

Data:	24 hours of up to 6 parameters with 10 second sample resolution per patient file
Storage:	31/2" dedicated floppy diskette
Initiation:	Manual

TREND PRINTER (Option 16L)

Type:	Hewlett-Packard LaserJet IIIP
Environment:	50° to 90.5° F (10° to 32.5° C) 20% to 80% humidity
AC Main:	115 Vac 10%; 50/60 Hz
Power:	44 watts (standby); 574 watts (printing)
Size:	8.25" (H) x 14" (W) x 16" (D) 20.8 cm (H) x 35.0 cm (W) x 40.5 cm (D)
Weight:	22 lbs (10.0 kg)

ACCESSORIES:

UNINTERRUPTIBLE POWER SUPPLY (UPS) (E2700-51)

Power Protection:	Provides up to 9 minutes of operation on power outages where line voltage falls below 103 Vac
Voltage Input Range:	103 Vac; 60 Hz
Environment:	0 to 40° C 0 to 95% humidity
Weight:	18 lbs. (8.2 kg)
Size:	6" (H) x 3.4" (W) x 13.1" (D) 151 mm (H) x 86 mm (W) x 333 mm (D)

ESCORT-LINK ALARM PANEL (E2700-55)

Visual Indicator:	Remote light panel, 24 configurable lamp positions
Audible Indicator:	One tone generator per panel
Number:	Up to 4 panels per ESCORT-LINK Central Station
Voltage Input Range:	103 to 130 Vac; 60 Hz

ESCORT-LINK DISPLAY EXTENSION CABLE (E2800-81)

Length:	Provides total of 10 ft. separation between video display and base
Cables:	Touchscreen and video

ESCORT-LINK ARCHIVE TO ASCII DATABASE CONVERSION PROGRAM (E2700-08)

NOTE: All specifications subject to change without notice.

8.4 GLOSSARY

TERM	EXPLANATION
Abnormal Beat	A beat or event that does not match the system's learned Normal beat for a given patient.
Alarm suspend	The ability to turn off all alarms for a period of time after which the alarms are automatically reactivated.
Algorithm	A set of instructions or software formula used to accomplish a task.
Archive	The ability to store data, usually for a long term, and be able to retrieve it. In the ESCORT-LINK this ability is an option that may be downloaded onto 31/2" diskettes for storage or use elsewhere.
Arrhythmia	Any deviation from the normal rhythm (sinus rhythm) of the heart. The natural pacemaker of the heart (the sinoatrial node), which lies in the wall of the right atrium, controls the rate and rhythm of the whole heart under the influence of the autonomic nervous system. It generates electrical impulses that spread to the atria and ventricles, via specialized conducting tissues, and cause them to contract normally. Arrhythmias result from a disturbance of the generation or conduction of these impulses and may be intermittent or continuous. They include ectopic beats, ectopic tachycardias, fibrillation, and heart block. Many result from heart diseases but also occur without apparent cause.
Arrhythmia event	A group of beats assigned to one of twelve categories that match the criteria of that group.
Asystole	Absence of a heart rate for more than 8 seconds; cardiac standstill or arrest.
Beat classification	The process by which each beat detected is compared to a template reflecting the patient's dominant cardiac beat and assigned to one of six categories.
BPM	Beats per minute (heart rate) or breaths per minute (respiration).
Bradycardia	Slowing of the heart rate to less than 40 BPM.

TERM	EXPLANATION
COMM OK	Indication that there is a good communication link between the Central Station and the bedside monitor.
CPU	Central Processing Unit: part of the computer's brain that actually performs arithmetic and logical operations.
CSA	Canadian Standards Association.
Digital	A sampled signal as opposed to an analog, or continuous, signal. The analog signal is sampled at a fixed interval, resulting in discrete samples which represent the analog signal. These samples can then be processed by a digital computer. The numeric values of the monitored parameters are digital values.
Diskette,31/2"	Floppy disk that is used in the Central Station to load **ESCORT-LINK** system software; also used in archive option 15L.
ECG	Electrocardiogram: a graphic tracing of the electric current produced by the electrical activity of the heart.
Ectopic Beat	A heart beat due to an impulse generated somewhere in the heart other than the sinoatrial node. Generally premature in timing, it is classified as supraventricular (originates in atria) or ventricular (originates in ventricles).
ESCORT	Bedside monitor that contains a transceiver/transponder to communicate with the Central Station.
FCC	Federal Communications Commission: government agency which assigns airwave frequencies; licenses UHF channels.
Fibrillation	A rapid and chaotic beating of the many individual muscle fibers of the heart, which is consequently unable to maintain effective synchronous contraction. Atrial fibrillation involves the atria only. Ventricular fibrillation involves the entire heart.
Heart Block	A condition in which conduction of the electrical impulses generated by the natural pacemaker of the heart is impaired, so that the pumping action of the heart is diminished. Measurement is in degrees, such as 1st, 2nd, or 3rd degree.

TERM	EXPLANATION
HR	Heart rate.
Late Beat	A beat where R to R interval exceeds the average R to R of the last 8 beats by more than 20%.
Lead	A portion of an electrocardiogram that is obtained from a combination of electrodes placed on a particular part of the body. Each lead represents the electrical activity of the heart as viewed from a different position on the body surface; identified by limb leads (I, II, III), augmented leads (AVR, AVL, AVF), and chest leads (V_{1-6}).
LED	Light emitting diode.
LINK *Base*	The PC portion of the **ESCORT-LINK** system.
LINK *Display*	13. diagonal color computer video display. VGA screen, 640 x 480 pixels, with user interface provided by Surface Wave Acoustics to detect finger placement.
Menu key	Key whose label changes as the various functions of the Central Station are accessed. The key and the label are one; when the key is touched and released a task is performed.
Missed Beat	A beat following an R-R interval that is longer than the average of the previous 8 R-R intervals by an amount of time determined by applying the MISSED BEAT factor.
Missed Beat Factor	A factor that is user adjustable from 1.5 to 3.0 in increments of 0.1, that is multiplied by the R-R interval of a late beat to determine whether to classify the beat as a missed beat. For example, the average R-R is 1 second and the MISSED BEAT factor is 1.8. A beat following an interval exceeding 1.8 seconds would be classified as MISSED.
Monitor	Any bedside instrument used to monitor patient parameters. This term does NOT apply to the LINK display.
NEXT PAGE	Key which indexes or turns the menu to the next available page of menu keys. When at the last available page, it returns the home menu.

TERM	EXPLANATION
Normal Beat	The beat morphology that was the dominant beat during the learning period of an arrhythmia channel. The template created from this learned morphology is then compared to each subsequent beat to determine whether the new beat is normal or abnormal.
%O_2 SAT	Percent of oxygen saturation; also identified as SaO_2 or SpO_2.
P/N	Part Number.
Parameter	A measurement of some factor, such as blood pressure, pulse rate, or hemoglobin level, that may have a bearing on the condition being investigated. Each numerical value that may be displayed on the monitor is considered a parameter value.
Premature	Clinical — An event or heart beat that is earlier than expected. System — A detected heart beat that is 20% earlier than the average of the last 8 R-R intervals.
PR	Pulse Rate.
Pulse Oximetry	SaO_2, SpO_2; the use of 2 light emitting diodes (LEDs) of given wavelengths located opposite a photodetector across an arterial vascular bed which measures the differences in the absorption of light by oxygenated and deoxygenated hemoglobin species contained within the vascular bed. The determination of arterial hemoglobin oxygen saturation is computed by the pulse oximeter from the relative amounts of light transmitted to the photodetector.
QRS Complex	The pattern on the ECG described when the electrical stimulus passes from the AV node down the ventricular conduction system and terminating in the ventricular myocardial cells.
Questionable Beat	A beat that is Abnormal but is occurring for the first time. This type of beat is labeled ? in the history review displays and printouts.
RF	Radio Frequency.

TERM	EXPLANATION
RF LINK	**ESCORT-LINK** communication in the UHF frequency band. Power level of transmitters is 50 milliwatts, which is several times greater than conventional UHF telemetry transmission.
RR	Respiration Rate.
R to R	The interval between 2 consecutive beats.
RS232	A hardware standard for digital communications. It defines the number of wires, voltage levels, and other technical information needed to interface. It does not define what data is sent, where the data comes from, or what should be done with it when received.
Run	Clinical — A sequence of consecutive beats that define such events as a run of SVT or Vtach. System — The number of consecutive abnormal beats at a rate over 100 BPM, equals or exceeds the RUN limit.
S/N	Serial Number: a unique number given to an instrument for identification purposes; it is located on the rear of each instrument.
SaO_2; SpO_2	The arterial hemoglobin oxygen saturation as determined by pulse oximetry; also known as SpO_2.
Slow Run	A run of consecutive abnormal beats at a heart rate less than 100 BPM, exceeds the limit.
Software	The set of instructions which define and control the functions of the instrument. Information is contained in the EPROM or other memory, depending on the program,which tells the instrument what its default configurations are.
Tachy	System — A sequence of premature normal beats at a rate greater than 120 that equal or exceed the Tachy limit.
Tachycardia	An increase in the heart rate above the rate designated as normal.
Telemetry	Transmission of information via radio frequency signals; in hospital setting, it normally refers to ambulatory ECG (telemetry) monitoring.

TERM	EXPLANATION
Template	The stored digital samples that represent the morphology of a QRS complex. Templates are stored for Normal and Abnormal beats. New beats are compared to the existing templates to determine whether they are Normal or an Abnormal that has been seen before. If an Abnormal has never been seen before, it is labeled a Questionable Beat, and its template is stored.
TM; TLM	Telemetry.
Touchscreen	System screen which allows interaction between the user and the menu key to activate a function.
Transceiver	The 2-way communicator that is a part of the ESCORT-LINK Central Station and the ESCORT bedside monitor which allows transmission and reception of signals to occur; also known as a Transponder.
Trend	The compression of information into a graphic display used to study the patient's vital signs.
UHF	Ultra-High Frequency: input carrier range of 457 to 470 MHz consisting of 227 channels and used for telemetry and ESCORT-LINK data transmission. Use of this frequency requires a license by the FCC. Range of transmission is 450 feet, outdoor line of sight.
UL	Underwriter's Laboratory.
UPS	Uninterruptible Power Supply: provides power to an electrical instrument for a short period of time. Option E2700-51 is used in conjunction with the ESCORT-LINK Central Station so there is no disruption of Central Station monitoring if hospital power is interrupted (and before the emergency generators might ignite).
Vtach	Ventricular Tachycardia: fast ventricular rhythm, usually greater than 120 beats per minute.
Vfib	Ventricular Fibrillation: an arrhythmia characterized by asynchronous contractions of the ventricular muscle due to rapid repetitive excitation of the myocardial fibers without coordinated contraction of the ventricle.

TERM	EXPLANATION
Vital signs	Measurements of physiological activity to include pulse, temperature, respiration, and blood pressure.
Wireless	Means by which data is transferred between instruments without the use of wires or optic fibers; can be done via radio frequency (RF), ultrasound, or infrared.